Project BRACER

Technical Report of the Remediation of the Biological Waste Pits Located Behind Building H-55, CFB Kingston, Ontario

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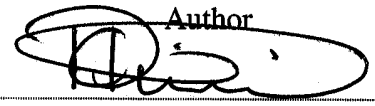

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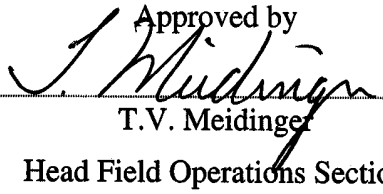

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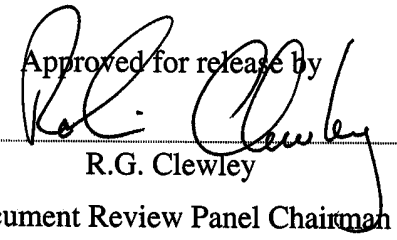

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1. Introduction

1.1 Background

The R&D programs at CFB Kingston took place in the old Defence Research Board (DRB) building which was known as H55 McNaughton. This building now houses the current Base Headquarters. The H55 facility was active from June 1953 until 1961 when the program was transferred to the Defence Research Establishment Ottawa. During DRB operations, an area 100 feet by 100 feet immediately north of the building was designated as contaminated ground with restricted access; within this area was a dumpsite. Although there is conflicting information as to the exact location and geometry of the dump, there is specific reference as to its contents. From reports, published papers and historical information, possible toxics contained in this site include wastes from the bacteriological warfare research program of the day, as well as radioactive tracers C and Cr; there is also information specific to small laboratory animals in plastic bags and metal cans.

Although direct linkage to the chemical warfare agent (CWA) program has never been made to the Kingston site, there was growing speculation that these materials, as well as their disseminators (ordnance), may have been part of the research program. Defence Research & Development Canada, Demilitarization Special Projects Team (DRDC DSPT) noted that every site they have remediated to date has yielded CWA, ordnance, pressure cylinders or combinations of these items. The DRDC DSPT was fully prepared to manage these materials if they were encountered.

During the period 1953 - 1980 there were no official waste disposal sites for super toxic materials such as CWAs and their residues; thus DRB excavated a number of pits for the disposal of chemical, biological and solid wastes resulting from the R/D programs of the day.

Given that many of the same personnel performing similar experiments were involved at CFB Kingston and DREO there was strong reason to suspect similar materiel was buried at the H-55 site.

1.2 Previous Investigations

Following transfer of the operations of the Defence Research Kingston Laboratory to the Defence Research Chamical Laboratory (now DRDC Ottawa), a number of studies and investigations were undertaken with respect to soils contamination. These were:

- "Contaminated Ground Study H-55, McNaughton Bldg" 11 August 1982 [1]; and
- "Assessment of Regional Contaminants H-55 Bldg" 15 August 1984 [2].

The studies were inconclusive as there was no bacteriological, chemical or radiological contamination detected. The aim of the investigations was to determine if any hazardous products were migrating through the soil

conveyed by casual water. The results of these investigations concluded that no migration of product was detected around the periphery of the site but no information as to the contents or condition of the actual burial site was obtained during either study.

1.3 Preparation

A detailed environmental assessment was registered prior to commencement of intrusive field operations. This document was supplemented by initialization and presentation of a public consultation process [2].
CFB Kingston formally requested DRDC Suffield (DRES R&D Bulletin 2001-4) be the lead organization on the project, given their expertise in remediation operations specific to recovery and disposal of chemical-biological agent-related materials, including ordnance. Approval for the team was by ADM (S&T).

1.4 Health And Safety Plan

The Health and Safety Plan was developed by DRDC Suffield to accommodate the on-site surveys and intrusive operations relating to Project BRACER. The plan was written in such a way that it could be amended to include additional intrusive investigations should it become necessary.

1.5 Emergency Response

While working at CFB Kingston all personnel including the DRDC Project Team operated according to local CFB Kingston Emergency Response Plans that were specific to CFB Kingston. In addition to the Kingston plan, the DRDC team employed a project specific "Initialization of Emergency Response Plan" that included detailed procedures for dealing with emergencies of a CBR nature. The plan was intended to accommodate medical emergencies as well as complex contamination control procedures (CB or Radiological in nature).
Given operating conditions, expected ambient temperatures for the project and available mitigation measures, there were no emergency scenarios with respect to chemical agent hazards that would cause the evacuation of personnel outside of the safety template established at each site. The safety template for the excavation, container removal and disposal operations was a 25 meters radius around each operational area.
Chemical agent monitoring using Chemical Agent Monitors (CAMs) as well as DRDC Suffield SOPs for decontaminating protective clothing was carried out before DRDC or other on-site staff were permitted to enter the decontamination trailer following each operation, emergency or otherwise. No (potentially) contaminated personnel were permitted to leave the contamination control zones until full decontamination had been carried out.

1.6 Safety, Environment And Security

Tasks associated with the project were carried out on a cooperative basis by CFB Kingston, the DRDC Team, HYTEC HRL, and the independent consultants responsible for the geophysical survey. Prior to commencement

of operations, a series of safety briefings were held at CFB Kingston, included input from CFB Kingston (General Site Safety, and Security), DRDC Suffield (Chemical, Biological and Explosives Safety), DRDC Ottawa (Radiation Safety) and HYTEC HRL.

Overall, CFB Kingston was responsible for general site safety during intrusive operations and any other operations carried out at the CFB Kingston site. DRDC and HYTEC operations were completed in accordance with Standing Operating Procedures (SOPs) referenced herein, the Project BRACER Health and Safety Plan, as well as this Field Technical Plan No. 364. The CFB Kingston OPI had full authority to unilaterally terminate activities and put the project into a safe condition had a hazard associated with waste materials or circumstances that contravened CFB Kingston Site Safety Procedures been encountered. Concurrence by the DRDC Field Technical Authority (FTA) (who is also the DRDC Project Manager [PM]) would be desirable, but not necessary, under these circumstances.

The DRDC PM/FTA retained overall responsibility for the safe conduct of DRDC operations associated with the project. He had full authority to suspend/cancel operations and place the project in a safe state at any time during the work.

For the purposes of the project, independent contractors or other personnel working on-site during the excavation and recovery of waste items were considered to be members of the DRDC Project Team and operated under the direction of the Field Technical Manager (FTM).

The site was manned 24 hours per day; silent hours (1830 – 0700 hrs) by the Canadian Corps of Commissionaires, and normal work hours (0700 – 1830 hrs) by DRDC personnel.

1.7 Project Name

For reference purposes, the DSPT assigned a project acronym for this project, *viz:* **BRACER** (Biological, Radiological And Chemical Environmental Remediation).

1.8 Aim

The aim of Project BRACER was to excavate the site as defined, examine anomalous regions within the site, recover, process and dispose of materials in a manner that maximized safety and protected the environment.

2. PROJECT OUTLINE

2.1 Phases

For planning purposes, Project BRACER was divided into three phases, *viz:*

- Phase I: Review of historical information, risk assessment of sites and development of remedial options;

- Phase II: Acceptance of Environmental Assessment, Planning, Contractural Agreements and initialization and completion of the Public Consultation Process; and

- Phase III: Intrusive investigations and remediation of the burial pit and crawl space of building H-55 on a priority basis based on appropriate options developed in Phase I.

2.2 Study Areas

A site plan for the H-55 area at CFB Kingston was reviewed and integrated with aerial photographs of the site (Fig 1).
The use of aerial photography assisted in the positive identification of a fenced area of approximately 800 square metres. This fenced area was typical in that sites of similar geometry have been found at other research establishments and facilities with known field trial programs, training areas and hazardous waste disposal sites. A detailed geophysical survey of the area that included the inner fenced area and regions outside the fenced site was conducted using electromagnetic survey equipment.

Fig.1. *Aerial view of Building H-55 taken in 1965*

2.3 Geophysical Survey

A geophysical survey was conducted by Geophysics GPR International Inc, who were sub-contracted by Aquafor Beech Engineering Ltd of Kingston, Ontario. The work scope included a comprehensive Electromagnetic (EM) survey of the suspect site and areas beyond the outer limits of the suspect region. The purpose of the investigation was to establish the existence of debris, unusual soil conductivity or anomalous areas that could be associated with former trenches or excavations.
The survey was performed December 16, 2001 and covered an area of approximately 3600 m^2. Data was collected at 1 meter intervals with a spacing of 2 meters between lines using a Geonics, EM-31 Terrain Conductivity Meter (TCM), with both the in-phase and quadrature components of the response being recorded.

2.4 Survey Results

A total of five trench anomalies were identified by the survey; in addition to this, it was known that the entire site was covered by a "Fill Anomaly". This feature is in the quadrature (conductivity) component. The background conductivity for the site is very low with values of less than 10, indicating very shallow bedrock (less than 1.5 meters) or the overburden is dry and coarse (sand and gravel). The five trench anomalies are apparent in both data sets, but only one appears to have metal pipe. The increase in conductivity

resulting from a trench anomaly is created by either disturbed soil or an increase in overburden.

2.5 Public Consultation Process

A pro-active consultation process involving CFB Kingston staff, and both local (Base) and general public (including media), was conducted before any site excavation work commenced. The process allowed individuals to (re)-familiarize themselves with project objectives, outline the approaches to be used and provide input into the project planning process. A series of two public meetings were held Wednesday, January 22, 2002 at CFB Kingston, Building A26 in the main auditorium. Both sessions were well attended by members of the general public and news media (radio, television and print). Following introductions and detailed historical account of the facility presented by the Base Commander, a scientific and technical briefing was provided by the DRDC project manager and his staff.
The consultation process was well received and generated a number of interesting questions. The process enabled both base and project staff to establish positive constructive relationships with the general public and media as was witnessed by the numerous requests for information and progress reports throughout the life of the project. Individuals representing DND and DRDC during the consultation process were:

2.5.1 CFB Kingston

- Colonel. P.J. Atkinson - Base Commander
- Mr. A. Wollin - Base Environmental Officer
- Capt Y.Cooper - PAFFO

2.5.2 DRDC Suffield

- Mr. K. Pirie - Project Manager\Field Technical Operations
- Dr P. Lecavalier - Organic Chemistry
- Dr W. Kournikakis - Bio-Chemistry

2.5.3 DRDC Ottawa

- Dr T. Cousins - Radiological
- Mr. Diego Estan - Radiological

2.5.4 Industry

- Mr. B. Armstrong - HYTEC, Hydrocarbon Reclamation Ltd

2.6 Remediation Plan

The remediation plan developed for Project BRACER is a close parallel to that developed for Project Oracle (Ottawa), and included approvals by Director General Nuclear Safety (DGNS), Director General Environment (DGE), DRDC Suffield and Ottawa and independent contractors. All operations carried out at the BRACER Site were in accordance with CFB Kingston local procedures related to General Safety, current and approved Radiation Safety Protocols, Site Access Control and Emergency Response Procedures, as well as DRDC developed Health and Safety and Emergency Response Plans specific to site intrusive investigations. Other key elements of the remediation plan included:

- Public Consultation Process;
- Deployment of specialised CBR and soil remediation equipment;
- Historical information document review;
- Completion of EM surveys of the BRACER site;
- Registration of EA;
- Production of Field Technical Plan;
- Health and Safety Plan;
- Initialization of Emergency Response Plan ;
- Commencement of intrusive operations;
- Analysis/segregation/disposal of recovered waste;
- Soils remediation process;
- Soils analysis;
- Site closure; and
- Disassembly of equipment – redeployment.

3. Scope

3.1 Agency Involvement

Five organizations were represented on the project, each with varying degrees of involvement and responsibility, however collectively they were accountable for the planning, implementation and execution of project objectives. They were:

- Defence Research and Development Canada – DRDC Suffield (Demilitarization Special Projects Team, (DSPT))
- Defence Research and Development Canada - DRDC Ottawa (DSPT)
- CFB Kingston
- HYTEC Ltd, Calgary, Alberta, and Aquafor Beach Engineering Ltd, Kingston Ont

3.2 CFB Kingston and External Agency Responsibilities

Responsibilities assumed by the Base and agencies are summarized as:

3.2.1 CFB Kingston

- Overall management and funding for Project BRACER;
- Base-related safety (excepting chemical, biological and radiological agent safety) and security;
- Provision of infrastructure and necessary commercial support through contracts, including the packaging and disposal of industrial chemicals and hazardous (non-chemical warfare agent related) waste, as required;
- Arrange the use of explosive demolition areas (if required by the project team);
- Provision of radiological materials storage area;
- Organizing and implementing the site staff, media and public consultation program, in conjunction with DRDC team and National Defence Headquarters Director General Public Affairs (DGPA); and
- Provide the contractor for independent soils analysis.

3.2.2 DRDC DSPT Project Manager (Suffield)

- Report directly to CFB Kingston Base Commander, and management of all aspects of project field operation activities;

- Establish Chemical, Biological and Radiological (CBR) agent safety procedures and protocols;
- Manage CBR collective protective systems and equipment;
- Manage site excavation, recovery and on-site disposal of CBR and non CBR waste;
- Production of operational documents (FTP, H&S and IER plans);
- Scientific and Technical advice to other agencies on all matters related to the recovery and disposal of Chemical-Biological agent materials; and
- Produce a technical report on completion of the project.

3.2.3 DRDC Ottawa DSPT

- Radiological safety and Radio Isotopic analysis;
- Safe handling, storage and disposal of any recovered radiological waste;
- Ensure radioactive (solid, liquid or gas/particulate) material is handled in accordance with current protocols;
- Installation and maintenance of radiological monitoring equipment; and
- Provide a technical account to the DRDC PM of work specific to radiological issues .

3.2.4 HYTEC HRL

- Prepare, ship and set-up the process equipment required in support of the soils remediation project;
- Supply PCA (Z2) of the correct molecular size and grade capable of absorbing specific Hazardous Materials including CWA and radiological;
- Supply and maintain the equipment necessary for segregation of hazardous and non-hazardous waste streams (soils, solids and liquids);
- Supply and operate the blending equipment for processing and mixing PCA (Z2) and soils materials;
- Ensure the correct quantities of PCA's (Z2) are blended at the correct rate and percentage for effective stabilization and remediation of contaminated soil;
- Ensure post-blended soils meet or exceed acceptable limits with respect to federal and provincial regulations for contaminated soil (whichever is the more stringent); and
- Backfill excavation with blended material (soil and zeolite).

3.2.5 Independent Consultant

- Analysis of soil samples prior to remedial actions;
- Analysis of soils samples post remedial operations;

- Conduct (if required) off-site ground water monitoring program; and
- Produce a report detailing the results of all sampling work.

3.3 Project Team

3.3.1 DRDC Suffield

- Mr Ken Pirie - Project Manager/Field Technical Authority
- Mr. Jim Reid - Field Technical Manager/ Technical Support Explosives
- Dr. Pierre Lecavalier - Scientific Authority (Chemical)
- Dr. Bill Kournikakis - Scientific Authority (Biological)
- Mr Chris Adie - Technical Support/Chemical Safety
- Mr Gary Soucey - Technical Support/Radiation Safety Coordination
- CWO John Deruyter - Technical Support Explosives/Military Liaison
- Mr Rob Matheson - Excavator Equipment Operator/Technical Services
- Mr Dean Verpy - Technical Support/Chemical Safety
- Mr Allan Verpy - Technical Support/Chemical Safety

3.3.2 DRDC Ottawa (Field Operations)

- Mr Rene Apps - Technical Support\General Safety
- Mr Pierre Richer - Technical Support\General Safety

3.3.3 DRDC Ottawa (Radiological)

- Dr Tom Cousins - Radiological Team Leader/ Scientific Authority
- Mr Bernie Hofarth - Technical Manager (radiological)
- Mr Diego Estan - Deputy Technical Manager (Radiological)
- Mr Justin Brown - Technical Support (radiological
- Mr. Rob Buhr - Technical Support (radiological)
- Mr R. Apps - CBR Technical Support
- Mr M. Boyle - CBR Technical Support
- Mr. P. Richer - CBR Technical Support

3.4 Sites Investigated

The site excavated was the disposal pit located approximately 60 m north east of building H-55 (Fig 2).

Fig 2.*The disposal pit covered by environmental structure*

The crawl space located in the north wing of Building H-55 (Fig 3).

Fig 3. *Crawl space located under Building H-55*

3.5 Site Preparation

A three man advance team from Suffield arrived at the Kingston site February 28, to begin site preparations. The majority of DRDC Suffield, Ottawa and HYTEC equipment had been pre-deployed to CFB Kingston in preparation for this initial phase. The advance party was responsible for the placement and erection of the environmental structures (Fig 4) and installation of other support facilities such as the DRDC decontamination trailer and medical service facilities (Annex A) (Fig 5). Installation and maintenance of electrical services was completed by the CFB Kingston electrical department. Other direct support was provided by the facilities Heating Plant personnel and General Labor crews from the Base.

Fig 4. *Environmental containment structure situated over the site*

Fig 5. *Support systems including medical, decontamination (ATCO) and rad detection van*

3.6 Unique And Specialized Equipment

In addition to the environmental structure, the DRDC team brought several unique and highly specialized equipment systems to support the project. The DRDC Suffield designed Explosive Exploitation Containment System (EECS) (Fig 6) was integrated with the Portable Assessment and Neutralization System (PANS) (Annex B) (Fig 7) and provided the team with the capability to explosively exploit cavities of both fuzed and unfuzed munition items should they be encountered. The EECS is designed to withstand explosive blast pressures produced by the intrusive investigation method. The EECS is an extremely effective tool when a requirement to conduct intrusive investigations of laboratory cylinders suspected of being charged with materials under high pressure exists. In addition, cylinder contents can be investigated safely in the confines of the integrated EECS\PANS systems.

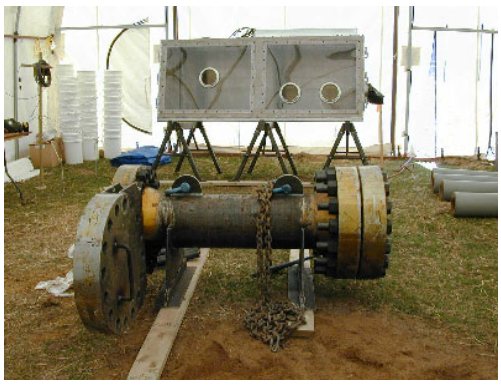

Fig 6*. The EECS being prepared for integration with the PANS (in Background)*

Fig 7. *PANS\EECS in the fully integrated configuration. Note the glove box design for operations*

3.7 Thermal Neutralization Unit (TNU)

The Thermal Neutralization Unit (TNU) developed at DRDC Suffield is a free-standing, cylindrical steel tank employed in the thermal treatment of neutralized Chemical Warfare Agents (CWA), primarily mustard, and other combustible and non-combustible laboratory waste. Methanol (methyl alcohol) (Annex C) is used as a combustion fuel for the TNU which is equipped with a small exhaust stack, forced-air inlet, and double steel doors that are secured during the combustion process. The fuel volume of the TNU is approximately 750 L or 3 x 45 gal drums of methanol (Fig 8).
During the combustion process, stack monitoring is carried out using Chemical Agent Monitors (CAMs) to confirm that the stack gases (primarily carbon dioxide and water vapour) do not contain agent. The combustion process and temperature can be controlled at all times through the speed setting of the forced-air fan. Methanol combustion is inherently clean with little or no observable smoke (particulate matter).

***Fig 8**. Thermal Neutralization Unit (TNU) with power generator and air blower system.*

3.8 NBCW Agent Monitoring Capabilities

A full suite of chemical detection and monitoring systems were employed during the conduct of all intrusive operations and product analysis operations. This included hand held Chemical Agent Monitors (CAMs) supplemented by the AP2C (Fig 9) as well as Nerve Agent Vapour Detection (NAVD) tickets and Detector Paper (Fig 10).

Fig 9. *AP2C (left) and CAM Chemical Agent Monitors. Both systems were employed during the project providing field operators with real time monitoring capability.*

Fig 10. *Nerve Agent Vapour Detection ticket (NAVD) (top 2) and standard issue chemical agent Detector Paper (DP). Both systems were employed at the site as verification tools.*

Hand held CAMs and the AP2C detection systems were supplemented by remote Chemical Agent Detection Systems (CADS) (Fig 11), strategically positioned prior to the start of daily operations. Two systems were active at all times during intrusive investigation and soils-blending operations, with one station positioned inside the environmental structure and the second station being outside, in a downwind location to monitor for any possible airborne contaminants. Each CAD system employed two CAM's, one "G" mode (nerve agent), the other in "H" mode (mustard). Monitoring data from each station was sent remotely to the Central Processing Unit (CPU) (Fig 11) that was installed in the Decontamination Trailer. Had agent been detected by either the internal or external CAD station an audible alarm would have been activated.

Fig 11. *Chemical Agent Detection System (CADS) Central Processing Unit (CPU) located in the decontamination trailer control room.*

Fig 12. *CAD station with two CAM's located inside the DRDC containment structure.*

DRDC radiological detection systems were deployed in support of the project and were responsible for quantitative, detailed analysis of soils and decontaminated waste product with respect to radiological contaminants. This complex analysis and monitoring capability was achieved by combining and integrating a full suite of Radiological Detection and monitoring capabilities for use in hand held, mobile downrange monitoring, and mobile vehicle mounted systems. (See Table.1). Personnel from DRDC Ottawa were the Technical Authorities on site for all radiological detection and material analysis issues. In addition to this they were responsible for the issue reading and recording of information accrued from personal Thermo-Luminiscent Detectors (TLD's) and EPD systems worn by all on site workers (Annex D).

Table 1. *Detector Readings*

MDL(microCi) for Given Radioisotope

Detector	^{60}Co	^{137}Cs	^{238}U	^{239}Pu	^{241}Am	^{90}Sr	^{3}H
ADM300[(a)]	0.1	0.5	100	-	100	0.5	-
DOSPEC [(b)]	$5x10^{-4}$	$4x10^{-4}$	10^{-2}	--	-	-	-
DREO HPGe ©	10^{-4}	5×10^{-4}	10^{-2}	10^{-2}	10^{-4}	-	-
DREO Portable HPGe[(f)]	5×10^{-3}	10^{-3}	5×10^{-1}	$5 x10^{-1}$	5×10^{-3}		
LEPP[(b)]	-	-	-	$1.4x10^{-4}$		-	20
HEBB[(b)]	N/A	N/A-	10^{-4}	10^{-4}	10^{-4}	9×10^{-6}	-
DREO portable Portable TriathlerLSC [(e)]	5×10^{-4}	5×10^{-5}	10^{-5}	10^{-5}	10^{-5}	$5 x10^{-6}$	10-6
DREO Canberra LSC[(d)]	5×10^{-5}	5×10^{-5}	10^{-6}	10^{-6}	10^{-6}	5×10^{-5}	10^{-5}

3.9 On Site Analytical Equipment

The DRDC Team had a portable Hapsite Gas Chromatograph\Mass Spectroscopy (GC\MS) (Fig 13) vapour detection capability. Although infrequently used during Project BRACER, this analytical tool is equipped with a comprehensive CWA library. The system is further complimented by an independent head space heater\analyser which provides the capability to retrieve otherwise unobtainable data from cold soils and contaminated materials.

Fig 13. *Hapsite GC\MS*

3.10 Personal Protective Ensembles

All protective equipment worn by the Project Team during recovery and segregation of hazardous waste were stocked, maintained and issued by the Project Decontamination Chemical Support Specialists through the Decontamination Trailer. Three levels of individual protective ensemble were utilized by the project team. The level of protection used was dependent on the activity undertaken, as shown in the following table.

Table 2. *PPE (Personel Protective Equipment) Levels*

ACTIVITY	PROTECTION LEVEL	DESCRIPTION
Non-intrusive site preparation, site(s) recce, install markers, prepare and position equipment, pre-decon stations, decontaminated equipment demobilization	LIGHT-1	Tyvek or cotton coveralls, playtex gloves, rubber boots, respirator handy
Explosive demolition work, prepare decon solutions, and TNU preparations.	LIGHT-2	Tyvek or cotton coveralls, playtex gloves, rubber boots, C4 respirator, cotton hood
Intrusive site work, "dirty" zone activities, excavation, waste materials recovery, waste materials segregation, segregated samples CAM and VOCs surveys, packaging and on-site transport, on-site disposal, demolition of suspect chemical ordnance, equipment and radiological and biological handling; personnel decontamination	FULL	CF NBC Individual Protective Ensemble, C4 Respirator, NBC Gloves or other rubber gloves, NBC Overboots, plus ARW red rubber overboots for pre-decon applications

All workers on site were required to wear the same level of individual protective equipment; (Fig 14) that is, if activities were underway that required FULL protection, no worker would wear a light protective ensemble on-site (Fig 15). The project team issued FULL protective ensemble to contractor personnel in cases where such personnel could have been exposed to CBR materials during intrusive site work, e.g. excavations. In instances where contact with liquid waste was possible, plastic splashguard material could have been worn on the sleeves and torso of the FULL protective equipment to increase protection against liquid splashes. For operations under cold ambient conditions, each level of protection was augmented by thermal underwear and innerwear, e.g. Wind River sweaters and pants, with the proviso that such innerwear was subjected to the normal clothing decontamination procedures during site operations.

Fig 14. *DRDC Team member in full Level II protective ensemble*

Fig 15. *DRDC Team members in Light-2 protective ensemble*

3.11 Contractor Specialized Equipment And Product

HYTEC Hydrocarbon Reclamation Ltd of Calgary, Alberta were contracted by DRDC Suffield to effectively blend and treat recovered soils as part of the remediation process. Blending operations included excavation of soil from site and blending it with Crystalline Aluminosilocate (PCA.Z-2) Zeolite (patented). (Figs 16 and 17)

Fig 16. *Zeolite as delivered in one ton totes.*

Fig 17. *The HYTEC Zeoloite/soils blending unit.*

3.12 Operations

3.12.1 Support And Installations

Site preparations involved the installation of hard wire connections for the multiple video camera coverage required to provide project management, as well as decontamination and emergency response personnel, real-time video monitoring of all site activities. Hard wire installation were also required for Chemical Agent Detection stations (2); one system was situated inside the environmental structure and (depending on wind direction) the second strategically positioned downwind from the structure and dig site. The decontamination facility also houses the office\laboratory area occupied by the Project Manager; this office was the focal point for information assimilation and dissemination. Three independently fed TV monitors with built in VHS recording capability were mounted atop the instrumentation platform while the Hapsite GC\MS, radio communications systems and CADs CPU occupied the available countertop space.

Four laptop computers were employed during operations with each having one or more specific functions. The Project Manager (or his designate) designated one laptop as the bullet log information gathering system; in addition to this, an e-mailing process was used to inform all parties on the Project "bullet log" Distribution List. A second laptop was used in the operation of the Hapsite GC\MS with the third used as the main-station for the downloading and re-production of all digital images specific to site operations. The fourth computer provided and recorded real-time weather information received from the on-site meteorological station.

Site operations (digging) commenced March 02, 2002; the project team and support personnel from local emergency (paramedic and a fully equipped emergency response vehicle) were on site daily at 0700 and 0800 respectively.

3.13 Intrusive Operations

3.13.1 Decontamination

The DRDC Suffield Decontamination Trailer was located inside the fenced off area of the work-site. This multi-role, self-contained trailer enabled the team to perform a number of complex tasks in contiguous manner, thus increasing the efficiency of operations. The environmental structures served as the main operations area specific to recovery of product; in addition to this, the structures were the central point for waste segregation, investigation, material analysis and non-CBR waste packaging operations.

The project employed a two-zone contamination control system; clean-dirty lines were established using stakes and survey tape. The environmental structures were located on the "dirty" side of the line. Transit to and from the Decontamination Trailer was by dedicated route only. Two (2) separate contamination control zones were established with the initial zone located at the point of egress (west end) of the environmental structure and is named "pre-decontamination".

The pre-decontamination station consisted of a boot-wash tray and hand-operated spraying equipment. Depending on ambient temperatures, a 5% bleach/water solution or (in colder conditions) mixtures of potassium hydroxide/methanol decontaminant was used for decontamination. Pre-decontamination is crucial since it significantly decreases the chance for cross-contamination of the site; supplemental footwear and gloves are removed and deposited in a waste container, while visual checks of the outer surfaces of protective ensembles and respirator are completed before workers leave the site and walk to control zone two.

The second control zone, located at the rear entry point of the decontamination trailer, is where final decontamination procedures were completed. Decontamination of personnel took place at the end of every work shift, or when workers left the work site. The procedures normally used during the Project BRACER are the same as those used to support other remediation projects, live agent field trials and training exercises. They include decontamination of outer protective clothing and equipment surfaces with a 5% bleach solution, carried out while individuals stand in a tray filled with bleach solution. The tray was located just in front of the stairs leading to the back entrance of the decontamination trailer. Protective ensembles were surveyed with a Chemical Agent Monitor to ensure no CWA agents were present. The doffing of protective clothing, boots and gloves took place in the rear room of the trailer with the assistance of the DRDC decontamination staff; all personnel passing through the decontamination trailer were required to shower before they were permitted to don personal clothing.

3.14 Excavation, Recovery and Disposal

3.14.1 Responsibility

The DRDC Team was responsible for excavation of the entire area identified as "suspect"; this included identification, recovery and decontamination of buried anomalies, as well as monitoring site conditions for the presence of fugitive chemical agent vapours, and destroying all discovered chemical-biological agent waste. DRDC Ottawa personnel were responsible for proper detailed identification

and disposal of any radiological waste found at the site. CFB Kingston was the authority for disposal of any hazardous or non-hazardous waste and other debris of a non-CBR nature that was accepted for disposal at licensed commercial waste facilities.

The site excavation was covered by three portable self-supporting Environmental Structures connected by specially designed joint flaps. (Fig 18) The three structures were similar in that they were 26 feet wide and 17 feet high, however the centre section was 48 feet in length as opposed to the two end units that were 32 feet long. Each individual unit was fitted with internal door closures allowing for separation between individual units. The structures were sited in an east to west orientation, with the eastern most structure and centre unit covering the actual dig area while the third (west) structure housed the soils blending unit and ancillary equipment. The project plan demanded an area over 50 feet wide x 80 feet in length be excavated to bedrock meaning all three structures had to be relocated one width (26 feet) directly to the south to accommodate project demands.

Fig 18. *Two containment structures in place over the site; the structure to the east (right) is the 32 foot unit, the structure at left (black tie-downs) is the larger 48 foot unit.*

Fig 19. *Internal door closures allowing separation of each structure. Photo taken facing east*

At 09:46 am on the morning of 02 March 2002, excavation operations at the Project BRACER site commenced. Site safety, monitoring and reporting procedures, as well as applicable radiological protocols were in place for all work activities at the site. Information collection and dissemination via written (Annex E), direct video link as well as voice and automated systems were implemented and continued until completion of all field operations.

A gravel seam (12 inches thick) was identified as the sub-base for the parking lot covering the entire site (Fig 20). The gravel layer was identified during interpretation of the geophysical survey

information. The gravel was removed from atop the indigenous clay (Fig 21) and relocated to a holding area on the north-east corner of the site. Prior to and during gravel removal operations, the material was screened continually for the presence of CBR contaminants using Chemical and Radiological monitoring and detection equipment.

Fig. 20. *The gravel seam being cleared from atop the site*

Fig. 21. *An example of the heavy wet clay soil*

During the remediation process there was a requirement to periodically examine soil batches from the excavator bucket and conduct frequent surveys using Chemical Agent Monitors to check for the presence of CWA. Other instruments employed in the detection process were the DRDC Hapsite portable GC/MS; the GC\MS was used in conjunction with CAM (H and G mode) and Radiological Detection systems such as the ADM-300 (Annex F). Soil batches and the excavator bucket were also frequently checked using a combination of microspec (with various probes), LSC and/or HPGe systems used in determining detectable levels of radiological material that may have been present. In the event that any statistically significant activity had been encountered on any of the radiological detection systems, there would have been a requirement to notify the staff of DGNS before any decision could be made on future actions (Annex G). No samples were transferred to radiological detection operations until it was determined they were free of chemical or biological contamination.

In addition to the extensive use of sensitive detection equipment, the team employed two electrically powered misting systems filled with 10% solutions of chlorinated bleach and water. (Fig. 22). This precautionary measure, part of the Field Technical Operating Procedures, was to ensure that in the unlikely event any biological material from the research programme had been deposited in the dump-site and had in fact survived the many years of burial, it would be effectively eradicated when exposed to the bleach spray and

misting operation. In addition to this, excavated soil (Fig. 23) being conveyed to the blending process was subjected to secondary misting and spraying operations, further minimizing the chances of airborne biological materials surviving.

Fig 22. *Bleaching of excavated soils "a precautionary measure"*

Fig. 23. *Bleaching operations involving excavated soils.*

At 11:12 am 02 March, the Field Technical Manager (FTM) reported that the "end" of what appeared to be a disposal pit had been uncovered; the recovery team was working from the east end of the structure moving in a westerly direction when the pit was discovered. (Fig 24). A number of anomalous items (glass tubes and plastic) were uncovered and digging operations were suspended while a detailed investigation of the immediate area was initiated; this included radiological and CAM surveys of the recovered product and surrounding soils.

Detailed updates of the investigative and analytical process were sent directly to the Project Manager; initial recovery operations resulted in the retrieval of laboratory glassware and approximately 25 culture tubes (typical of those from a biological program). The tubes were in some cases intact (sealed), however the majority were in various states of deterioration, including broken and ruptured condition. The sealed tubes were partially filled with a reddish brown liquid. (Fig 25). A number of these sealed items were segregated and taken to the PANS for further analysis and testing; each tube was opened and subjected to a number of tests including detector paper (negative reaction) and pH analysis resulting in a pH level of 12, suggesting the material originally resident in the tube had been exposed to decontamination processes. The test procedures confirmed no CB or R agents were present in any of the material or items tested. Monitoring of the excavated area and of product interlaced in the soil was done on a regular basis to ensure no CBR material was present. As a precautionary measure, and in keeping with operational and

mitigation procedures, the excavated pit was partially re-covered with soil at the end of each work shift or when other priority work was being conducted to ensure that safety mechanisms and precautions were in effect while the dig-site was not directly supervised by field operators.

Product removal and waste segregation operations continued for the remainder of the day; any unopened containers were crushed under neutralization solutions resulting in the accumulation of quantity four 20 litre pails filled with neutralized product, solid waste (glass) and solution. Each pail of material including the neutralization solution was checked for the presence of CBR; although no levels of CBR agents were ever detected standard procedures and protocols demand that all recovered material be subjected to neutralization procedures which include being immersed in solutions of 10% Potassium Hydroxide (weight\volume) in methanol. After a pre-determined "soak" time the solution is drained for re-use and the cleansed material transferred to the Thermal Neutralization Unit (TNU) for final reduction.

Fig 24. *The exposed end of the disposal pit with test tubes, plastic and laboratory waste material clearly visible in the excavation; testing revealed no CBR contamination.*

Fig 25. *Recovered product after testing for the presence of CB or R contamination*

Fig.26. *Field Technician removing product from the excavator bucket.*

Fig 27. *Technicians monitoring the excavation process. Note the video camera in background.*

Waste recovery, segregation neutralization and thermal treatment operations continued until 06 March, at which time it was determined the disposal pit had been completely remediated; a detailed inventory of the material recovered (Annex H) was produced, however the inventory was not officially distributed until completion of all operations since there was concern that additional material would be discovered during soils processing operations. Disposal pit dimensions were approximately 17 feet long and 3 feet wide at the surface, tapering down to approximately 18 inches at its base. Actual depth of the pit was difficult to determine since the bedrock base continually changed elevation, however estimates put the depth at about 6 feet (nominal).

Although a number of interesting discoveries were made such as the autoclaved remains of a rabbit and bags of animal bedding material (wood chips) no material of a Chemical or Biological Warfare or Radiological nature was ever recovered or detected at the disposal site or from the soil.

With the exception of a white powder, identified as gypsum, a quantity of Mercury (20 ml) and Mercury contaminated waste, as well as a uniquely designed plastic bottle containing approximately 25 ml of hydrofluoric acid (disposed of through commercial entity), no other anomalous liquid waste or material other than garbage (wood and small metal debris) was discovered. All recovered product was subjected to full decontamination procedures prior to final treatment in the TNU.

A total of 24 jars (Fig 28) and bottles of varying geometry were recovered (Fig 29) over the life of the dig, and secured in sealed containers (20 litre pails). Each item was opened and the contents subjected to testing; all were determined to be water-filled and no CWA or radiological contamination was detected. As in keeping with procedures, the items were immersed in mixtures of potassium hydroxide and methanol prior to being placed in the TNU.

Fig 28. *Typical waste recovered from the excavation. Note the different container dimensions.*

Fig 29. *A typical 250 ml bottle recovered from the pit; this item contained 20 ml of water.*

3.15 Thermal Neutralization Unit (TNU)

The TNU was normally used at the end of each shift and has three distinct functions: initially it ensures that any CWA which could be impregnated in metal will not survive the temperatures to which it is subjected; secondly it thermally reduces waste quantities, thus decreasing the amount of product requiring shipment off site to commercial facilities; and thirdly, it can be used in emergency situations in the destruction CWA in ordnance or other container types.

Temperatures within the TNU normally exceed 700 ^{o}C as the methanol fuel is consumed. Such temperatures are well above those needed for the complete thermal destruction of CW agents, particularly mustard, neutralization by-products and for the thermal decontamination of the containers.

Approximately 2 hours is usually required to complete the destruction process for each batch load, plus an additional hour to allow the apparatus to cool. Waste recovered after TNU treatment was carefully packaged in approved 45 gallon waste containers and labelled. CFB Kingston hazardous material management personnel ensured the waste was transported off-site for disposal at commercial facilities.

3.16 Environmental Protection And Monitoring

Radiological detection capabilities, as well as Chemical Agent Monitors (CAMs) mounted in two CAD II stations, were deployed downwind and monitored stack gases for the presence of any CW agent vapour or radiological particulate. The combustion process was controlled by changing the forced-air delivery flow rate, thus changing the internal temperature of the combustion chamber should this be necessary to eliminate residual vapour emissions. Prior to, and after each combustion operation, swipes from the batch were subjected to analysis by LSC.
Post combustion, the TNU contained residues of potassium; CAM and radiological protection equipment was used to survey the interior compartment of the TNU as well as the reduced waste. Surveys were carried out while the interior temperature of the TNU was above 25 ^{o}C.

Fig 30. *Once surveyed for CB and R contamination, ash from TNU operation is stored in 45 gallon drums.*

3.17 Soils Blending And Area Remediation

Before blending operations could begin, all DRDC project team equipment that had been strategically positioned in the containment structure had to be relocated to maximize available space. This proved to be a significant challenge since the operational capability of the equipment had to be maintained in anticipation of any emergency situation that could have arisen at any time during soils blending operations. A considerable amount of time was dedicated to the planning and relocation process since improper placement of the equipment could have resulted in difficulties during emergencies and costly time delays.

HYTEC Hydrocarbon Reclamation Ltd, of Calgary Alberta were contracted to complete the 2000 cubic meter soils blending operations. The co-blending product used was Porous Crystalline Aluminosilicate (PCA) (Z-2 patented). The product has some very unique capabilities with respect to hydrocarbon absorption from soils and other media including CWA and radiological materials. The soils blending operation was a considerable undertaking especially in light of the time constraints and the fact that all three containment structures had to be relocated so as to accommodate the area requiring excavation, blending and replacement. HYTEC provided the specially designed equipment used to efficiently and effectively blend recovered soil with Zeolite.

Fig 31. *Field Technicians preparing one of the containment structures for its relocation*

Fig 32. *The structure used to house the blending operation (left) ready for moving.*

Fig 33. *Soils blending unit located inside unit 3 of the containment structure.*

Fig 34. *Soils being prepared for transport to the blending operation*

To ensure sufficient throughput of soil, a series of conveyor systems and equipment capable of efficiently moving the soil were employed (Fig 35 and 36). Material and soils being transported also had to be visually checked for any product or items that may have gone undetected during the initial screening process.

Fig 35. *Soils being delivered to the conveyor system. Note the field operators inspecting the soil for anomalous items or material.*

Fig 36. *Soils bleach misting operation.*

As discussed, a major portion of the remediation plan saw the use of Zeolite as the primary method of absorbing contaminants from soil and standing water. (Fig 37) With this in mind, a layer of Zeolite was placed atop the bedrock thus preventing the migration of any hazardous product should it be present, (CWA or otherwise). This was done prior to the excavation being backfilled with blended Zeolite and soils.

Fig 37. *Zeolite being distributed over the bedrock.*

Zeolite blending operations were successfully completed without incident or discovery of any other material or items related to the research program being discovered. (21 March 2002). During operations approximately one hundred and eighty tons of Zeolite was blended with the soil; this was in accordance with plans and projections.

With soils processing completed, the project team began site breakdown work that saw the tear down , repack and shipping off site of a vast majority of the support equipment, field supplies and monitoring capabilities. Most of the equipment identified as CBR demilitarization equipment was shipped to DRDC Ottawa where it will remain in storage pending re-assignment and deployment to other potentially hazardous sites. The DRDC Suffield decontamination trailer was also shipped to Ottawa.

A final briefing of media, general public and base employees was held in the main auditorium of building A-26 on the morning of 25 March 2002. The briefing provided a full description of what had transpired over the life of the Project.

3.18 Off-Site Monitoring

CFB Kingston conducted a sampling operation which targeted residential water wells. The sampling was specific to the detection of CB agents (Annex H). The analysis results were negative with respect to the presence of CB materials in the water or any of the products associated with their deterioration (Annex I).

4. CONCLUSIONS

Project Bracer was completed successfully, within the allotted time and under budget. The project was conducted over a period of eighteen months and resulted in the production of a number of support documents specific to the planning, execution and remediation operations. An area of some 800 square meters (2000 cubic meters of soil) was excavated, blended with Zeolite and completely remediated during the clean-up process; a single disposal pit was discovered in this area. As discussed, laboratory glassware, product in sealed tubes and general waste material recovered from the pit had been thoroughly decontaminated or autoclaved prior to being deposited in the disposal pit.

5. REFERENCES

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ANNEX A – MEDICAL SUPPORT AND ON-SITE AMBULANCE REQUIREMENTS

Project Site Ambulance Requirements

1. Project BRACER intrusive investigation required the employment of various pieces of mechanical equipment, specialized hazardous materiels handling facilities and extensive manual labor. There existed the potential for injury of personnel by industrial equipment and by no-standard locally-produced, improvised equipment specially designed for hazardous site operations. Initial response times for local emergency responders (paramedics) originating from Kingston is unknown, however typical city response times can range from a few minutes (8) up to forty-five minutes. In light of these response times, BRACER management have requested that on site medical support be stationed at the DRDC Suffield decontamination facility whenever intrusive operations are in progress.

2. Project BRACER should have at its disposal the use of a stand-by (on-Site) Ambulance with a minimum of one (2) Paramedics who will be ready to accept a casualty. This ensures that any emergency medical situation can be managed immediately by the on-site medical staff (MS). They Paramedics are responsible for administration of initial emergency treatment and stabilization of casualties prior to transportation of casualties to a local hospital for additional treatment. DRDC Suffield decontamination staff will accompany any project team member to the hospital. This is done to ensure that attending physicians are fully briefed with regard to injuries and/or exposures that the casualty may have sustained or been subjected to. Additionally, the DRDC Suffield decontamination staff member will brief the physician on any antidote or supplemental medications that may have been administered.

ANNEX B - PORTABLE ASSESSMENT AND NEUTRALIZATION SYSTEM AND INTEGRATED EXPLOSIVE EXPLOITATION CONTAINMENT SYSTEM

DESCRIPTIVE INFORMATION

Explosive Exploitation Containment System

1. The DRES Explosive Exploitation Containment System (EECS) is integrated with the Portable Assessment and Neutralization System (PANS). This specially designed equipment provides DRES field staff the capability to explosively exploit cavities of both fuzed and unfuzed munition items suspected of having CW agent fillers in a safe, effective and environmentally acceptable manner. (DRES SOP-018) Disposal by Detonation; Remote Explosive Fuze Removal; and, Explosive Penetration Using Shaped Charge Technology).

2. The EECS is designed to withstand explosive blast pressures produced by the intrusive investigation method; DRDC Suffield will utilize RP1 detonators with highly specialized shaped charge (SC) attachments. In addition to being suitable for munition exploitation operations the EECS is an extremely effective tool when there is a requirement to conduct intrusive investigations of laboratory cylinders suspected of being charged with materials under high pressure; they can be exploited safely in the confines of the integrated EECS\PANS systems.

Portable Assessment and Neutralization System (PANS)

3. The PANS in combination with the EECS is designed specifically for site remediation and chemical weapon demilitarization operations where items and containers suspected of having chemical warfare (CW) agent fills can be opened, contents assessed and sampled, and if necessary materiels destroyed safely in a controlled manner.

4. The PANS is a closed loop system that provides operators with a number of material processing options and equipment usage; sampling operations can be conducted without compromising the integrity of the PANS. In addition to this the PANS incorporates a continuous flow, agent neutralization system employing three independently operated pump units.

5. The PANS incorporates two supplementary emergency response features; those being an automated water injection system which can be used to expediently spray water under pressure into the PANS in order to “knock down” gaseous material; and an automated rapid fill nitrogen injection capability designed to overpressure and expediently flush the PANS system by forcing material through twin air filtration units.

6. Any emergency situation involving the EECS/PANS would likely emanate from a catastrophic system failure caused by and inadvertent explosive blast. If this occurred while the system operators were in close proximity to the unit serious injuries would result; there is a possibility that the situation would be complicated by the dissemination of toxic chemical warfare agents and contamination of personnel. The DRDC Suffield decontamination staff would be the initial responders to such an event supplemented by other available DRDC Suffield staff.

ANNEX C – THERMAL NEUTRALIZATION UNIT

DESCRIPTIVE INFORMATION

Thermal Neutralization Unit

1. The Thermal Neutralization Unit (TNU) developed at DRDC Suffield, is a free-standing, cylindrical steel tank which is used for the thermal treatment of neutralized chemical Warfare Agents (CWA), primarily mustard, and other combustible laboratory chemical waste. Methanol (methyl alcohol) is used as a combustion fuel. The TNU is equipped with a small exhaust stack, a forced-air inlet stack and double steel doors that are secured during the combustion process. The fuel volume of the Cooker is approximately 750 L or 3 x 45 gal drums of methanol.

2. For mustard agent destruction, the non-explosive ordnance container (e.g. Livens mortar) filled with mustard agent is first drilled (under containment) under cool temperatures (e.g. < 5 ^{o}C) and with the agent fill in a frozen condition. In some field situations, small explosive perforating charges, similar to those used in the oil/gas industry for perforating well casings, may be used to provide container openings. These holes are necessary to provide pressure relief once the combustion process is initiated. The perforated containers (e.g. up to 4x Livens mortars) are then placed on a grate in the bottom of the TNU and completely submerged in methanol. Potassium hydroxide is usually added to the methanol (e.g. 5-10% KOH in methanol solution) to promote chemical neutralization of the agent fill and to provide a caustic solution for neutralizing any acid gases produced during the combustion process. The TNU door is closed and a small electric motor-driven forced-air fan is activated to provide combustion air. The methanol is remotely ignited using a small secondary igniter (fussee) placed within the TNU. The entire volume of methanol is allowed to burn completely over a period of a few hours. Temperatures within the TNU exceed 700^{o}C during this time -- this temperature is sufficient to completely destroy any mustard fill, organic by-products, and to thermally decontaminate the agent containers.

3. During the combustion process, stack monitoring is carried out using Chemical Agent Monitors (CAMs) to confirm that the stack gases (primarily carbon dioxide and water vapour) do not contain agent. The combustion process and temperature can be controlled at all times through the speed setting of the forced-air fan. Methanol combustion is inherently clean with little or no observable smoke (particulate matter).

ANNEX D – RADIOLOGICAL DOSIMETRY AND SOILS SAMPLING REPORT

Introduction

1. DRDC Ottawa was tasked by project BRACER to provide personal dosimetry for all individuals working in the project area. As well, DRDC Ottawa was charged with ensuring no radiological contamination was present in materials removed from the site, or on instruments and equipment used for excavation and destruction of chemical waste, etc.

2. Following is a brief summary of data collected. It does not include detailed analysis of the data, but said data can be provided upon request.

Electronic Personal Dosimeter (EPD) Readings

3. Typical EPD measurements observed for the Kingston area were approximately 1 – 3 µSv per day due to fluctuations ambient background. Therefore, this permits an accumulation of up to 3 µSv per day, with no undue concern of a radiological hazard in the working environment.

4. Each morning the total shallow (HS) and deep (HP) dose was recorded from each individual's EPD. At day's end, the EPD's HP and HS dose were read and compared to previous data.

TLD Data

5. DRDC Ottawa's Hypersensitive TLDs (aluminium oxide), were issued to all personal entering the excavation site. Again, at day's end, the TLDs were read and compared to a background TLD located in the Boiler room (temporary radiological lab). Any TLDs reading higher then double the background reading would be investigated. Fortunately no anomalous readings were found.

Personal Dosimetry Summary

6. Following is a summary of EPD and TLD data for excavation personnel.

Name	John Deruyler		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
2-Mar	3.000	0.000	0.012
3-Mar	0.000	1.000	0.000
4-Mar	1.000	1.000	0.000
5-Mar	2.000	0.000	0.000
6-Mar	1.000	1.000	0.000
8-Mar	0.000	0.000	0.000
9-Mar	0.000	6.000	0.000

Name	Red Apps		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
2-Mar	1.000	0.000	0.003
3-Mar	1.000	1.000	0.000
4-Mar	2.000	0.000	0.000
5-Mar	1.000	0.000	0.000
6-Mar	0.000	0.000	0.000
8-Mar	1.000	0.000	0.000
9-Mar	0.000	0.000	0.000
10-Mar	0.000	0.000	0.000
11-Mar	2.000	1.000	0.000
12-Mar	1.000	0.000	0.000
13-Mar	1.000	0.000	0.000
14-Mar	0.000	2.000	0.000
15-Mar	2.000	0.000	0.000
16-Mar	1.000	1.000	0.000
17-Mar	1.000	0.000	0.090
18-Mar	0.000	1.000	0.013
19-Mar	1.000	1.000	0.050
20-Mar	0.000	0.000	0.000

Name	Pierre Richer		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
2-Mar	1.000	0.000	0.000
3-Mar	0.000	1.000	0.000
4-Mar	1.000	1.000	0.000
5-Mar	0.000	3.000	0.000
6-Mar	0.000	1.000	0.000
8-Mar	5.000	2.000	0.000
9-Mar	2.000	2.000	0.000
10-Mar	0.000	2.000	0.000
11-Mar	1.000	2.000	0.000
12-Mar	1.000	2.000	0.000
13-Mar	1.000	2.000	0.000
14-Mar	1.000	2.000	0.000
15-Mar	3.000	2.000	0.166
16-Mar	3.000	2.000	0.000
17-Mar	1.000	2.000	0.296
18-Mar	1.000	2.000	0.000
19-Mar	1.000	1.000	0.234
20-Mar	1.000	1.000	0.000

Name	Rob Matheson		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
2-Mar	1.000	0.000	0.124
3-Mar	1.000	1.000	0.022
4-Mar	2.000	0.000	0.000
5-Mar	1.000	0.000	0.002
6-Mar	1.000	0.000	0.013
8-Mar	1.000	0.000	0.000
9-Mar	1.000	0.000	0.000
10-Mar	0.000	0.000	0.000
11-Mar	0.000	1.000	0.000
12-Mar	1.000	0.000	0.000
13-Mar	1.000	1.000	0.000
14-Mar	0.000	0.000	0.000
15-Mar	1.000	1.000	0.000
16-Mar	2.000	0.000	0.000
17-Mar	1.000	1.000	0.000
18-Mar	0.000	0.000	0.017
19-Mar	0.000	1.000	0.000
20-Mar	0.000	0.000	0.000
21-Mar	0.000	0.000	0.000

Name	Jim Ried		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
2-Mar	1.000	1.000	0.246
3-Mar	0.000	1.000	0.016
4-Mar	2.000	0.000	0.016
5-Mar	1.000	0.000	0.025
6-Mar	2.000	0.000	0.016
8-Mar	0.000	0.000	0.000
9-Mar	0.000	0.000	0.000
10-Mar	0.000	0.000	0.000
11-Mar	1.000	2.000	0.000
12-Mar	1.000	0.000	0.000
13-Mar	1.000	1.000	0.000
14-Mar	0.000	1.000	0.279
15-Mar	1.000	1.000	0.003
16-Mar	1.000	0.000	0.000
17-Mar	1.000	1.000	0.000
18-Mar	0.000	0.000	0.079
19-Mar	1.000	1.000	0.058
20-Mar	1.000	0.000	0.000
21-Mar	1.000	0.000	0.000

Name	Gary Soucey		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
2-Mar	0.000	0.000	0.282
3-Mar	0.000	1.000	0.005
4-Mar	1.000	1.000	0.000
5-Mar	0.000	0.000	0.005
6-Mar	0.000	1.000	0.000
8-Mar	0.000	0.000	0.000
9-Mar	1.000	1.000	0.000
10-Mar	0.000	0.000	0.000
11-Mar	1.000	1.000	0.000

Name	Brian Armstrong		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
8-Mar	0.000	0.000	0.000
9-Mar	0.000	1.000	0.000
10-Mar	1.000	1.000	0.000
11-Mar	1.000	1.000	0.000
12-Mar	0.000	1.000	0.000
13-Mar	1.000	0.000	0.000
14-Mar	1.000	1.000	0.116
15-Mar	0.000	1.000	0.032
16-Mar	1.000	0.000	0.000
17-Mar	0.000	1.000	0.277
18-Mar	0.000	1.000	0.000
19-Mar	0.000	0.000	0.233
20-Mar	0.000	1.000	0.000
21-Mar	1.000	1.000	0.000

Name	Denis Young		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
8-Mar	0.000	1.000	0.000
9-Mar	1.000	1.000	0.000
10-Mar	0.000	1.000	0.000
11-Mar	1.000	1.000	0.000
12-Mar	1.000	1.000	0.000
13-Mar	0.000	1.000	0.000
14-Mar	n/a	n/a	0.216
15-Mar	n/a	n/a	0.000
16-Mar	n/a	n/a	0.000
17-Mar	n/a	n/a	0.000
18-Mar	n/a	n/a	0.000
19-Mar	n/a	n/a	0.000
20-Mar	n/a	n/a	0.000
21-Mar	0.000	1.000	0.000

Name	Chris Adie		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
12-Mar	0.000	1.000	0.226
13-Mar	1.000	0.000	0.000
14-Mar	1.000	1.000	0.000
15-Mar	1.000	1.000	0.000
16-Mar	2.000	0.000	0.000
17-Mar	0.000	1.000	0.000
18-Mar	0.000	0.000	0.419
19-Mar	1.000	2.000	0.211
20-Mar	1.000	1.000	0.126
21-Mar	1.000	1.000	0.000

Name	Rob Buhr		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
12-Mar	0.000	1.000	0.000
13-Mar	0.000	0.000	0.000
14-Mar	1.000	1.000	0.000
15-Mar	2.000	0.000	0.000
16-Mar	2.000	1.000	0.000
17-Mar	0.000	1.000	0.000
18-Mar	1.000	1.000	0.016
19-Mar	1.000	1.000	0.000
20-Mar	1.000	1.000	0.000
21-Mar	0.000	0.000	0.000

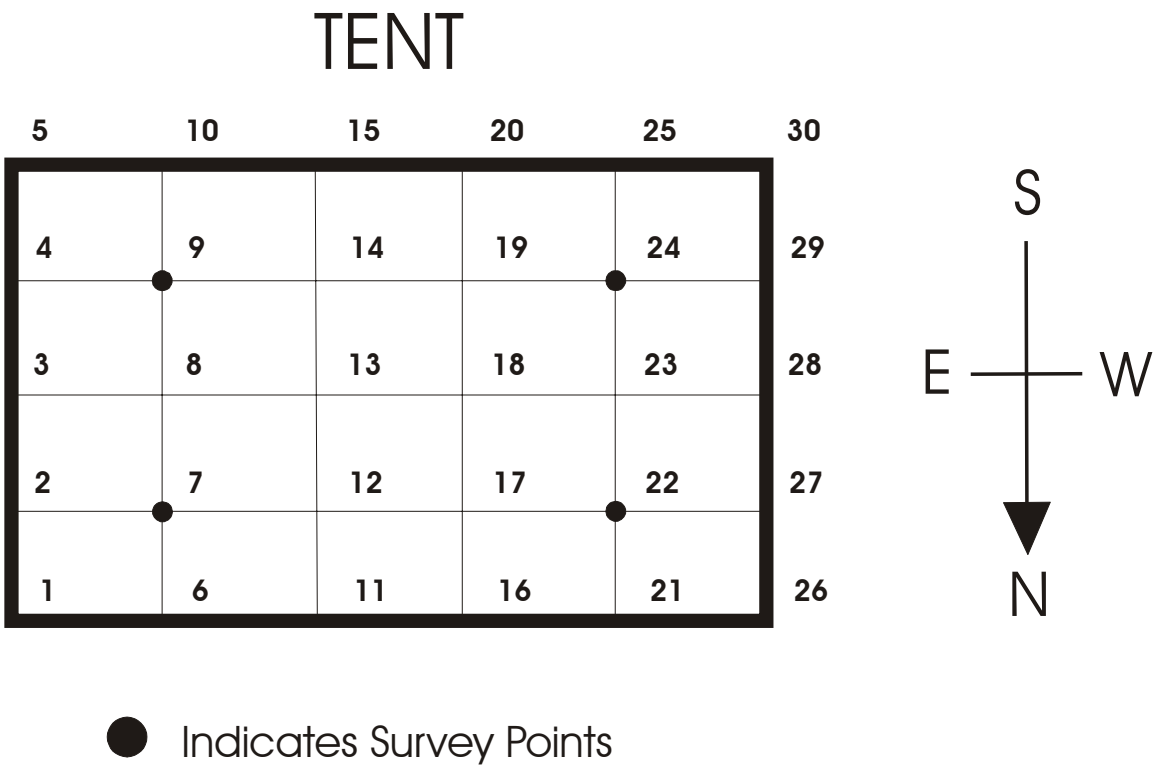
Name	Jason Brown		
Date	EPD Daily Dose		TLD Daily Dose
	HS (uSv)	HP (uSv)	m/R
12-Mar	2.000	1.000	0.000
13-Mar	0.000	0.000	0.000
14-Mar	1.000	1.000	0.000
15-Mar	1.000	1.000	0.000
16-Mar	1.000	0.000	0.000

Survey Grid Reference

7. Inside the DRDC Suffield portable excavation structure, an alpha, beta and gamma survey was conducted each afternoon before lunch break and at the end of each day. The grid below depicts the four locations inside the tent where measurements were recorded.

8. All measurements were made using the ADM300C survey meter.

9. In summary, data indicated that no readings ever exceeded background levels.



Note:
For Gamma, typical ADM300C "background" measurements were about 0.18 – 0.20 µSv/h. While this is slightly higher that nominal background measurements of approximately 0.1 µSv/h, as measured by spectroscopy equipment, it is consistent with previously observed over-responses of this meter at low dose rates. The overall detection range of the ADM300C is 0.10 µSv/h to 100 Sv/h with (±) 15% efficiency.

Readings between 4.50 CPS to 6.00 CPS were used as a background reference, for alpha and beta readings using the ABP-100. The ABP-100 has an over all detection range of 0 – 20000 CPS for both alpha and beta detection, with a uniform efficiency of (±) 20%.

Liquid Scintillation Counter (LSC) KOH Samples

10. Before a burn in the Thermal Neutralization Unit (TNU), samples of the KOH were extracted from containers filled with product from the excavation site. The KOH samples were combined with LSC cocktail and then read in the portable Hidex LSC. It was noted in the course of the analysis that the KOH itself caused luminescence, giving false counts on the LSC. Vials were analysed several times to verify the counts produced were due to KOH luminescence. It was noted that this luminescence had a time dependence, i.e.: the luminescence faded over several minutes, therefore, the measurement protocol was adjusted to take into account the KOH phenomena.

11. None of the samples processed through the portable LSC showed signs of radiological contaminants.

Thermal Neutralization Unit (TNU) Swipes

12. After each burn, swipes of the TNU were taken. The swipes were read in the portable Hidex LSC. Sr-90 protocol was used for a fully open window of counts (i.e. 0 – 2000 keV). 20 ml of AB cocktail was added to each sample vial. Again, the KOH protocol had to be observed due to presence of KOH in swipe samples.

13. None of the samples processed through the portable LSC showed signs of radiological contaminants.

Soil Samples

14. The following diagram indicates the location and elevation of each soil sample. Bedrock was close to the surface on the west end of the tent, allowing only 5 soil samples at the 6-foot mark. Eight samples at the surface and 3-foot mark were obtained.

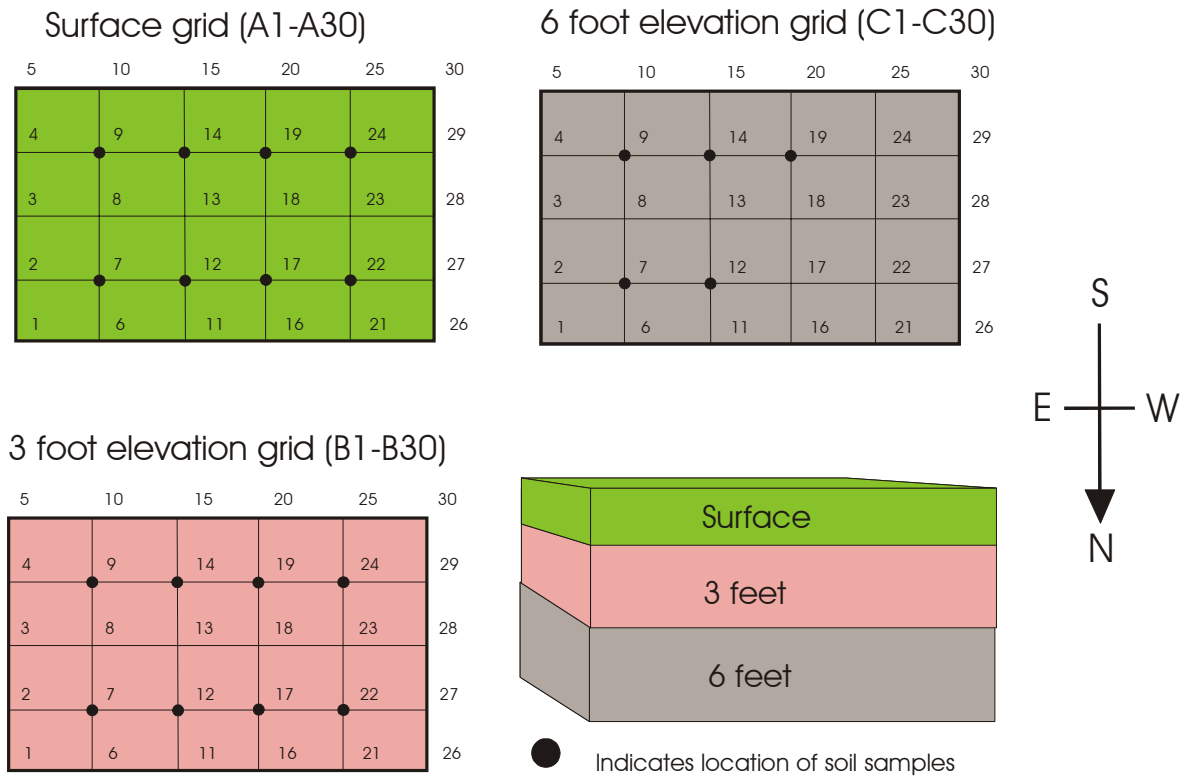


Figure 1 – Soil sample grid references

LSC Analysis

15. Soil recovered from the excavation site was measured in the portable Hidex LSC. A small amount of soil was placed in a vial with 20 ml of AB cocktail. Soil samples from

outside the perimeter were used for background reference. The Sr-90 protocol was used on the LSC.

16. None of the samples processed through the portable LSC showed signs of radiological contaminants.

MicroSpec II Data – Soil Samples

17. Three types of probes were used to analyse samples from the excavation site. B-type probe for beta detection, E-type probe for gammas, and LEPP-type probe used to detect low energy photons. All probes provided dose rate, total dose, and spectroscopic information when connected to the MicroSpec II base.

18. B-type probe using a phoswich detector for beta radiation, detects electrons ranging from 100 keV to 4 MeV.

19. E-type probe 2"x 2" NaI crystal suitable for environmental use, is capable of detecting gammas ranging from 60keV to 3MeV.

20. LEPP-type probe using a phoswich design for low energy photons, detected photons ranging from 2 keV to 100 keV.

21. None of the measurements using the Micro Spec II and probes showed anomalous readings. Natural Radium was detected in the soil samples; however, this was probably due to the natural Radium in the bedrock located at the excavation site.

Conclusions

22. No untoward radiation sources were observed in either dosimetric or spectral radiation detectors. Personal dosimetry showed typical background levels only.

ANNEX E – BULLET LOGS

Bullet Log
28 Feb 02

0730 DRES pers on site
0745 all equipment being unpacked and prepared
0800 CE and military helpers arrive on site
0820 FTM has all site pers at structure assembly ops
0830 Ken visits PAFO to find out what is going on
0930 Ken to HQ to download e-mail
1030 Ken back to the Decon trlr
1100 all going well at site, power almost up and running
1130 all pers break for lunch
1245 all pers back on site
1300 ken begins to get rid of materials from trailer and set up ops facility
1400 Structures up
1500 equipment being set up in structures
1530 power completely installed, sparky running power to the site via a panel board
1630 jim to Ottawa, ken and Rob to the fire hall to brief fire dept
1720 Ken and Rob back at hotel
1730 Red called to establish plans..the team will meet at 2100
1735 Ken downloads mail

Bullet Log
01 March 2002

0730 team arrives on site
0800 team meeting
0830 equipment set up operations
0900

Bullet Log
02 March 02

0700 team assembles
0720 team arrives at site
0730 team meeting to discus preparation and digging plan
0735 call signs assigned to individuals
0740 printer cable issues addressed
0745 Red and Pierre drill holes in tamper plates
0745 EPD`s and TLD`s assigned to individuals
0750 FTM checking out earbuds…not compatible with respirator; normal ops adopted
0750 Gary preparing rad survey tables
0750 Diego preparing rad survey instrumentation
0755 Rad survey complete, Diego to input data on table
0758 preparations continuing

0800 Call signs assigned as follows

Alpha	Trailer Contol Office
Delta 1	Ken (mobile)
Delta 2	Jim
Delta 3	John
Delta 4	Gary
Delta 5	Rob
Delta 6	Radiological Diego
Delta 7	Dean
Delta 8	Red
Delta 9	Pierre
Delta 10	Medic

0802 paramedic arrives on site (David) he was immediately briefed and is happy with the set up, his emergency response equipment is now located in the trailer.
O820 Delta 3 conducts metallic survey, a number of positive hits were recorded
0825 Delta 7 set up CAD stations
0830 Delta 7 set up met station
0832 Delta 2 conducts site survey
0835 Delta 2 and 5 establish the dig plan
0840 Delta 1 requests Brian Armstrong pick up a new printer since the one in the trailer has died
0845 Delta 1 requests Koh\Me mix to begin, D 7 will supervise this operation
0900 Delta 4 on a shopping run to can tire
0915 all team members in full IPE
0920 Delta 2 tests the emergency evacuation procedures and capability..all 100%
0920 Delta 1 crates lists for phone and emergency callout
0930 all personnel to site after recording EPD readouts (see table)
0935 D3 Activates CADS auto alarm 100%
0940 D2 completes evac ex
0940 Col Atkinson called to get a quick sit-rep
0944 all video links up and running
0945 d5 running up excavator
0946 Dig ops commence
0950 Temp –1 cel. Dir 190 degrees at 12 Kph
0955 CAM survey negative on G and H
0959 dig process continuing
1005 dig encountering wet clay
1020 Cam Survey and metallic surveys negative
1030 HYTEC on site with new printer
1032 D4 returns from CT run
1035 printer up and running
1035 callsign list produced
1039 CAM surveys and rad surveys negative on G H, rad background
1040 Drew at trailer
1050 D2 reports that 2 excavations of 8 ft (bedrock have been completed, no materials found to date
1110 CAM surveys, negative G and H
1111 HYTEC back on site
1112 D2 reports bio vials\test tubes recovered (total of 25 at this time)
1116 D2 reports 1 bar G on CAM

1118 D2 request paper to site, D8 will pick-up
1120 recovery of tubes continuing
1130 radio link camera system tested and running
1132 radio link camera to site for installation
1138 ADM-300 on site
1147 RAD survey being conducted
1150 Rad results are background on both beta and gamma
1158 D2 has continued the dig in order to make safe for lunch break
1208 Site marked with flags, the seam is located and the excavation will be backfilled for lunch
1210 D2 is completing process ops in preparation for site closure
1217 D4 brings liquid sample back to trailer for rad survey
1220 D5 returns to decon
1222 worksite now safe and closed for lunch
1225 D5 shower and decon
1226 D8, 9 and 3 back at decon and showered
1229 D2 back through decon
1230 Site closed and made safe
1245 all pers leave site for lunch

1345 team back on site and preparing for pm ops
1350 D2 advised of new camera positions
1400 Team dressing
1420 D2 and crew deploying to site
1420 HYTEC crew to lunch
1425 Video uplinks established
1425 D7 preparing TNU
1425 D6 has requested soils samples and liquid (koh\me) for radiological analysis
1430 EPD readouts recorded
1435 Rob moving methanol
1440 D2 and D3 coms check
1442 D8 and D9 coms check
1444 D2 assembling camera's
1445 D4 to site for sample retrieval
1450 D5 coms check
1450 video problems being worked on
1455 soil sample back at rad area
1500 Zeolite moved into containment and opened
1505 zeolite will be spread on the bedrock to absorb any moisture
1509 D2 advises dig ops to re-commence
1510 Col Atkinson visits site
1514 D4 to site with rad survey instrumentation
1515 CAM surveys negative on each response
1517 both video links operating, recording systems operating
1520 HYTEC generator arrives on site
1525 radio control cameras returned to trailer for reset
1530 D6 confirms soils and liquid samples are nor rad contaminated
1535 D7 is preparing the TNU
1540 D4 taking cameras back to site
1541 D2 moving VHS camera

1542 D5 digging from opposite (east) direction
1558 D2 reports that he has established the edge of the pit
1600 D2 orders zeolite application into hole
1604 second video recorder operating for overall site view
1610 D2 waiting for zeolite dust to settle, D5 will then fill the trench and begin dig ops on opposite side of the structure
1615 D7 preparing the TNU for lighting
1617 D6 preparing downrange sampling
1620 d2 moving cameras
1629 d2 delivering neutralized product
1630 wind changes dictate that rad sampling (particulate) be placed outside of the fenceline
1635 blower motor functioning
1635 battery on CADS disconnected
1635 CAM surveys negative G and H, rad survey clear
1640 D4 setting up power lines for particulate sampler
1650 D3 lights TNU
1655 Pers decon from site
1700 video moved inside
1704 Stack temp on TNU at 600 cel, body temp at 550
1710 site made safe D2 back at decon
1720 TNU burn complete

BULLET LOG
March 03, 02

0800 Team assembles
0810 deploy to site
0820 team arrives at site, preparations begin for work day
0825 Rad swipes taken from TNU
0830 team begins dressing
0900 site preps complete team ready to deploy
0905 D2 will take the small digital to the site to get some good footage of recovered waste
0910 team deploys and conducts coms check
0920 D2, 3, 8, 9 and 5 at site
0921 CAMS sent to site for CADS stations
0928 Met station set up and operating
0930 dig ops commence
0935 Tractor moved to new dig location
0945 D2 requests two 2x6 to be sent to site and placed under tracks
0950 D2 reports product being found
1000 Met conditions: wind calm 180 degrees, +7 cel
1001 D2 reports test tubes and construction waste being recovered
1002 D3 returns to decon for respirator adjustment
1007 D2 reports fluffs bedding, we will remove a sample for rad analysis, chem. Analysis will be performed at site
1008 Bleach misting systems turned on
1010 CAM survey completed, negative G and H
1015 spray operations continue
1030 Rad surveys on fluffs bedding and soils background

1030 D4 returning to trailer
1030 HYTEC on site, Denis and Brian sign of on H&S plan
1032 D2 reports more vials filled with dark brown liquid recovered; tests to follow
1037 D2 requests additional koh\me
1040 old lumber continuing to be recovered along with fluffs bedding and vials
1041 D1 leave trailer to speak with rad survey group
1055 D1 returns to trailer, Rad sampling continuing (complete at 1100 hrs)
1055 D2 advises that he is video taping the opening of the vials and the analytical procedures
1057 advises containers of waste to be processed by 1130 hrs
1059 D7 is preparing the TNU for an 1130 ignition
1104 D4 and 7 removing the ash from the TNU, the ash will be placed in a 45 galon haz waste container.
1108 D4 requests sample vials for koh\me
1109 Rad and CAM suveys negative
1110 D4 picked up sample containers
1111 D2 requests additional white pails
1125 D2 advises that he has a lot of product which will be processed prior to breaking for lunch.
1126 all recovered waste now being prepared for TNU
1127 D3 moving neutralized product to TNU
1130 CAM and Rad surveys negative all modes
1133 Site digging operations have ceased and the excavation has been covered by approx 2 feet on clean fill
1135 sample of koh\me at trailer, Diego to pick up
1145 D6 advises that the liquid koh\me sample is negative for rad contamination
1150 all waste loaded in TNU
1215 TNU ignition and burn
1215 Final decon for site personnel
1235 site closed for lunch
1245 team leaves site (D7 stayed behind to charge equipment and clean trailer

!345 team back at site
1346 the plan is now to consolidate equipment and begin dig from a new area
1350 Drew back on site downloading video
1430 team to site
1431 coms checks being conducted
1435 dig operations begin
1438 D2 reports the met station has been damaged
1440 Met station at back door of trailer
1450 recovery proceeding
1515 the structure is being severely stressed by the wind (50 – 60 kph) the team is currently trying to re-tie the hold-downs
1520 D4 reports that a rad survey of the site and the recovered waste was background on both Alpha and Beta
1535 D2 preparing waste product fro the TNU
1536 The environmental structures have been re-secured and appear to be ok at this time
1538 waste recovery ongoing
1545 digging ops closed for the day to facilitate site clean up, TNU charging and mitigation operations
1558 D5 backfilling and adding zeolite
1605 CADSstation dismantled and removed from site

1608 bleaching unit removed from site
1610 TNU being charged with fuel and product (all product to this point is bio related)
1625 TNU ready
1627 TNU ignited
1635 D3 through decon
1640 D8 and D9 through decon
1642 D2 and D5 securing site
1650 site closed for the evening, commissionare on site, medic sent home.

04 March 02
Bullet Log

0700 Team assembles
0710 team arrives at site
0715 A work schedule is prepared and the following will be completed:
- TNU analysis for TNU ash (rad contamination) will be conducted
- TNU ash removed from TNU and placed in Haz waste container
- PANS\EECS moved to a new position in the structure
- 25 gallons Koh\me to be mixed
- Once clean, the TNU will be re-located
- HYTEC will begin assembly of the blender plant and consolodation of zeolite stocks closer to site
- The dig site operation will be reconfigured to accommodate the next phase of the dig
- 0720 team dressing for site ops

0735 D9 will remain at decon this AM to assist in deco set-up and other tasks
0740 HYTEC equipment has arrived
0745 medic on site, moving his equipment inside trailer
0745 bullet logs of 02 and 03 March have been sent to the appropriate parties for review
0800 site fully operational personnel leaving trailer for site
0804 HYTEC moving equipment to create space for the zeolite
0809 D6 reports that rad counts are clear from TNU ash, we are waiting for the LSC results before continuing
0811 D4 replenishing water supply
0814 rad survey of TNU ash and swipes of the interior of the TNU are clean
0825 called Jerry at Hertz rentals to order 3 more barrels of methanol (this will be a total of 7)
0840 all coms check completed
0850 rad survey of site negative
0855 CAM surveys of site clear
0900 CADS stations tested, all systems operating normally
0910 PA NS\EECS moved to new location
0930 D2 requests battery change out for CAM
0931 D3 requests air valve to be sent to site
0932 D3 inflating fork lift tire then move fork lift to gate area
0940 D2 requests 4 new sets of work gloves for to site
0940 D1 contacts Drew to supply No. 8 screws for trailer door, he will deliver
0942 site preps continuing
0950 trailer door repairs complete

0951 Drew arrives on site, he has a concern with the quantity of material recovered to date, this is not a concern to DRES since the quantity of material will provide accurate information as to the scope of the program.
0952 Drew will have the consultant on site for soils sampling runs
1000 D8 decons
1002 D9 begins order for can tire run
1003 D3 prepares TNU for a burn
1005 to date 10 X 5 gallon pails of neutralized waste has been processed through the TNU this equates to the following:

- 1500 laboratory vials both of glass and plastic construction
- 40 bags of bedding waste (small animal)
- small quantities of construction waste (wood and metal scrap

1012 Trackhoe moved in to move hard soil for bobcat, D2 conducted a CAM survey of the soil; negative G and H.
1015 TNU ignited
1017 D8 and (move cars to other location while HYTEC unload equipment
1020 met conditions as follows: wind 190 degrees, at 12 kph, air tem –9 cel
1021 D2 requests small digital to site for pics
1030 TNU stack temperature at 590 cel
1032 Containment structure being closed up for resumption of dig, all equipment has been relocated
1035 D4 to site to conduct rad survey
1040 D2 reports shelter secure and ready for PM operations
1045 D4 reports background on rad survey
1130 site secured and pers heading for early lunch

1235 team back to site
1235 more HYTEC equipment delivered to site
1240 team preparing for ops
1245 short meeting to discuss planned operations
1300 D6 has taken TNU swipes and is analyzing at this time
1315 D5 moving zeolite to the site
1330 D5 moving slip tank from contractors vehicle
1345 digging commences
1350 D2 reports that he has hit product at the 3 foot level, tree roots and other material
1355 CAD station re-tested, all good
1400 D2 inspects excavation
1407 Product has been uncovered on the right side of the excavation, D5 is wirking through this area in attempts to establish the width of the pit
1410 D7 takes a 9volt to D4
1415 D4 reports that the product being recovered is vials and ampoules of material there is also a quantity of lab glassware including stoppers and tubing.
1430 D1 notifies D6 that his samples will require a higher state of handling care.
1431 D2 report Fluff recovered: this validates historical reports
1445 The Whig standard called (Jennifer Pritchett)
1500 D2 reports 1 pail of fluff and fluff material and 1 pail of vials: D2 figures that he will fill another 2 pails of product from the recovered soil
1510 Capt Cooper confirms that Jennifer Pritchet will come to the site

1515 D4 and 2 confirm very small quantity of mercury in a localized area of site, it is isolated in that it is present only in one location
1525 D4 takes digital video to site
1630 interview with Jennifer Pritchet, went well
1550 D4 delivering material to site
1550 D4 will do a CT run
1700 Product still being recovered but site to be made safe until operations tomorrow
1705 Delta 1 to prep TNU for burn and to recover KOH sample for rad analysis
1720 TNU started
1721 Decon started
1800 D4 and 7 continue to clean trailer
1808 TNU generator shut down
1900 TNU cooled for inspection, all in order
1905 site secured fr the evening
1930 team meeting at hotel to discus plans fr 05 March
Ken download e-mail

05 March 02
Bullet Log

0700 team meets
0702 PM reads Whig standard..good report
0720 PM and FTM establish that the vial count for 04 March was 1900, this brings the total vial count to 3400; there are also 3 X 5 gallon pails of fluff material; 12 lab jars of dye material (tracer) and qty 10 septum containers (10 ml) of medical supplies.
0730 team prepares for ops
0730 all (3) real time monitoring systems up and running, VCRs recording
0732 PM and FTM discuss options with shaker system, the decision is
- Move shaker into structure
- Position it in the most ergonomically advantageous position
- Move unwanted soils away from work area
- Complete a test run of the shaker using clean soil
- Move on to a contaminated soil process
- Evaluate and report on the feasibility of the shaker

0745 TNU samples (swipe and solid) taken
0750 site equipment up and running
0758 HYTEC moving and positioning equipment
0800 zeolite being positioned for use
0800 medic on site and briefed on CBR hazards
0805 Team to site
0807 D6 reports that the TNU samples are clean
0810 soils being moved to accommodate equipment
0815 shaker moved into containment structure
0825 CAM survey conducted: negative G and H mode
0830 CADS stations on and tested, positive alarms, system verified
0830 Drew Wollin on site
0838 team moving downrange sampling equipment to coincide with current met conditions
0850 Met readouts as follows: W\direction 240 degrees, at 8 kph, Ambient air not available at this time.

0900 D4 recharging water supply system
0905 exhaust hose still not at site, holding up ops…waiting for large gloves as well
0915 team coming back to trailer in open state
0917 Shaker running
0920 D2 reports that the shaker is not providing the desired results
0930 The shaker will be restarted and tried with wet product
0935 the hose is now on site: it will be fitted to the shaker
0940 team back at trailer for a short break
0945 team returns to site
0950 D1 visits PAFO to discuss Whig report, all positive
0952 pre-med tech arrives on site with air quality instruments (Co2)
0955 CAM survey G and H negative
1000 D2 re-positioning cameras
1000 Andrew Wollen brought in two visitors, peter Smith and Bob Campbell
1010 D4 did rad survey with all readings as background only
1030 D2 requested digital video camera and battery for bleach sprayer
1035 D4 to fill in D1 on items found
1040 Andrew Wollin puts in request to local base supply to try and find suits for Hy-Tec personell
1110 shaker being decontaminated
1111 door latch on trailer broken, brian repairing
1115 D2 and team making site safe
1117 D5 moving shaker out of containment
1125 Drew advises that the garbage container and mobile lab will have to move to make room for the atco
1130 CAM surveys complete, negative on both H and G modes
1145 team decontaminated
1200 team to lunch, site in safe condition
1200 medic trailer arrives on site

1300 team back from lunch
1305 team preparing for ops
1310 load printer driver on secondary laptop
1320 team deploys to site, coms checks good
1345 Andrew to trailer
1400 D2 CAM survey reports negative on G and H
1408 waste being recovered, vials and glassware
1410 D6 requesting 2 soils samples for rad analysis
1412 capt Cooper informs D1 that 2 media reaps wish to conduct interviews, Justin Thompson CBC radio\Ontario Morning, and Joe Brean, The National Post
1415 – 1435 Phone interview with Joe Brean
1430 D4 conducted a rad survey of the site, all background
1430 D6 received 2 soil samples for analysis
1445 – 1510 Phone interview with CBC Justin Thompson, he will do the live radio interview in the AM
1500 waste recovery operations proceeding
1510 called Jennifer to info her of CBC request

1515 d2 reports that the excavation to this point has been cleared of waste; he will place a bag of zeolite and spread it through the pit. The dig will continue in a westerly direction (toward the TNU).
1520 D4 reports we have 24 jars, mostly empty, we also have three plastic containers, two of which are empty and one which requires further investigation
1520 D1 to speak with PAFO
1550 Wind 190 degrees, 15 kph
1600 TNU prepared and lit
1600 D1 reports a white powder, Ph test confirms 11, we conclude gypsum..a sample will be brought to the trailer and drew will have it analyzed.
1615 a final exploratory dig will be completed by D1, if no other product is recovered the site will be secured for the evening

1630 TNU running at full tilt, (620 cel)
1630 Justn from CBC called back, the report interview will take place at 06:40 hrs and will be conducted by Erica Ritter of CBC
1635 D2 reports site clear of haz mat
1640 final CAM and RAD sweep completed, negative H, G and Rad
1645 site secured, commissionaire on site
NOTE: final totals of recovered product will be available in the PM.

06 March 02
Bullet Log

0640 D1 preparing for CBC radio interview
0700 D2 joins D1 for interview
0730 CBC calls D1 and begins set-up
0742 Interview begins with Erica Ritter CBC
0750 Interview over; it went very well
0752 The report in National post was well done (a few odd remarks but generally well done)
0800 team arrives on site
0810 team meeting to discus the plans for the day this will include:

- Waste segregation operations
- Soils management
- Equipment consolidation
- Removal of unwanted equipment
- Process of jar product
- TNU preparation
- Rad and CB surveys
- Separation of materials in 5 gallon pails

0820 Drew to site
0830 efforts to secure a third containment system are not going well therefore D1 has decided that a 3 ton cube van will be rented; D8 and a HYTEC employee will drive to Ottawa (DREO) to pick up the third DRES containment unit, this will be assembled Thursday (PM) in preparation for soils remediation.

NOTE: The project is ahead of DRES projected target dates and milestones, all operations are moving forward.

0845 AP2C charged and ready to go to site
0850 Coms. check good. Medic (Gail) is on site.
0900 EPD readings recorded and issued to team members
0915 D8 and HYTEC leave for Ottawa
0930 Drew departs trailer
0935 team deploys to site
0940 D1 to speak with PAFO
1000 D1 returns from PAFO and meeting with D4 ref management jars
1000 D2 reports all CAM and Rad surveys clear, Negative G and H, alpha, beta background
1010 HYTEC back to trailer
1045 D2 reports that the mercury waste is being separated
1046 D4is still processing waste from the jars
1047 D7 preparing the trailer for decon ops
1105 D4 reports that the 250 ml bottle he sampled has provided negative H, negative AP2C but 8 bar G with 3 rip on CAM. CAM is very slow to clear.
1106 Survey continuing
1107 TNU being prepared
1107 D4 reports a 500 ml jar negative H and Ap2C, however 5 bar G with 3 rip on CAM
1110 D4 is working on a 500 ml ground glass container which is not aqueous (not frozen)and very mobile(like alcohol)..testing continuing
1112 D7 preparing 5 gallons clean water to be sent to site
1115 D4 reports 500 ml brown glass bottle identified as sulphur CAMS gave negative response on H and G modes however AP2C was illuminated on H indicator identifying sulphur, trhe product was immersed in koh\me, turning the solution brown in color
1121 D3 has completed the the mercury separation and is now processing glass waste
1124 D2 continues to process jars
1130 D4 reports the he has a material which has hung a CAM on 1 Bar, this appears to be diesel fuel additive most likely hexane or hexane, a similar material was encountered at DREO
1132 D4 reports 4 250 ml jars of organic liquid in and unfrozen state, this product will be processed as per procedures
1135 Drew returns to trailer
1135 roads and grounds guys may tour the trailer
1136 D4 has found the source of the mercury (500 ml polyethylene bottle) and has isolated this container with the recovered\processed mercury contamination which has now been transferred to a 45 gallon hazardous waste container. Large barrels are sealed and labeled “Liquid Mercury Waste”
1140 TNU preps continuing
1142 D6 reports the the latest rad survey of koh\me is clean
1143 d2 reports the mercury container is bagged and tagged and in now under containment
1155 D3 reports he is ready for TNU ignition
1155 D4 advises that decon bleach and generator gasoline is required on site
1215 TNU burn commences
1220 Staff to decon
1230 Staff to lunch
1330 Staff back from lunch – with gasoline for generator and bleach for decon. New Medic (Susan) on site. Discuss afternoon work plan
1400 Staff dress for site –prep trailer and equipment –haul water for shower, etc.

1430 Staff to site –commence drilling of tent frame in prep. for move.
1435 CAM survey with negative results in both modes
1440 Rob moving PANS out of tent with forklift
1445 D1 informs Col Atkinson that the pit has been cleared of recoverable waste, however there are no firm time estimates on when soils remediation work will be completed
1450 Diego to take swabs for analyses from the TNU
1515 Drilling of shelter frame proceeding very very slowly
1520 Report on TNU swabs – background only
1550 D4 reports the following:

- 250 ml brown glass jar, yellow dye, water soluble, neg H, G and AP2C
- 500 ml neg H, G and AP2C
- 500 ml clear liquid Neg H, G and AP2C
- 250 ml Clear liquid neg H, pos G neg AP2C
- 250 ml neg H, Pos G, Pos AP2C H and V
- 250 Ml with rubber stopper, neg H, Pos G, Neg AP2C
- 500 ml cracked glass container with solid marker dye

These products will be reacted in koh\me
1623 D4 requests D6 prepare TNU sampler
1625 D4 and D3 prepare TNU
1625 D4 reacting product
1625 D8 and HYTEC return from Ottawa with containment structure
1628 D2 reports tha he has approximately 6 more frames to drill
1630 D4 and D3 begin neutralization of seven containers;

- container 3, was added to koh\me no reaction, added to TNU
- container 1 was added to koh\me, solution turned yellow, no other reaction, neg AP2C, but pos G on CAM with 3 rip.
- Contents of pail 1 to TNU
- Container 2, added to koh\me no reaction, AP2C, responds on V.
- Container 2 to TNU
- Container 4, added to koh\me, no reaction, neg AP2C, taken directly to TNU
- Container 5, added to 5 liter of koh\me, yellow liquid, neg on AP2C, directly to TNU
- Container 6, added to 5 litre of koh\me, blod red color, no reaction, neg on AP2C, directly to TNU

1700 TNU loaded with product, final product totals will be produced on return of D2, 3, 8 and 9
1703 D4 reports that he has sampled material in a specially designed polyethylene container, a Ph test provided less than 1. It is strongly suspected that there is a mixture of hydrofluoric acid and water in the container. This material must be disposed of "off-site"
1705 D6 takes liquid sample for rad survey
1708 D3 ignites TNU
1708 Site secure for the evening
1716 TNU at 590 Cel
1720 team through Decon
1820 team leaves site.

08 March 02
Bullet Log

0700 team to site
0715 team arrives on site
0730 site crew briefed as to the plan for the day
0745 equipment being moved into structure
0800 medical staff arrive on site
0805 CADs stations redeployed to outside the structure
0810 D4 repairing the met station
0815 D2 to site with team
0815 D1 online to DRES
0820 D6 requests print out of microspec template
0820 called to request sandbags (waiting for reply)
0830 CADs powered up
0830 D4 successfully repairs the met station
0835 D1 to main building to send a fax to DRES
0900 media on site, till 1030 hrs
1040 last media leave site
1040 process area continues to be prepared for soils remediation
1200 lunch
1300 team returns to site
1310 D1 called Patty Doonan for info on the
1315 Paramedic on site
1315 prep continuing
1445 HYTEC running up equipment
1600 medic informed it will be a 0800 start time
1605 site secured for the evening, HYTEC require 20 amp breakers for the conveyors
1605 team preparing trailer for shut down
Note: no soils remediation work was conducted today, this work will begin in the AM of the 09 March 02.

09 March 02
Bullet Log

0730 team gathers
0800 team on site
0801 Soil sample grid established, alpha\numeric grid; A – D, 4 samples per station
0810 D1 and 2 to site
0812 all instrumentation
0817 Drew on site
0818 medic on site
0818 HYTEC running up equipment
0819 new bobcat on site it has an air purification system
0822 breakers on conveyor system causing some concern, but the situation seems to be stable at this time
0840 Rob Buhr has taken over from Diego Estan in the Rad facility, Justin Brown will take over the Rad van from Bernie
all site personnel now in respiratory protection for soils remediation ops

0850 CADs station up and running
0900 Protective clothing levels are now, resirator, tyvec, rubber gloves and boots, hoods are up.
0910 D5 excavating soils
0914 briefing medic
0930 Rad survey of soil background
0930 CAM survey negative H and G
0935 Drew to pick up generator
0940 team to trailer for break
0955 generator arrives on site
1008 still having problems with the zeolite feed,
1200 the solution to the feed issue is to conduct blending operation as soils is recovered
1210 lunch
1300 return from lunch
1315 zeolite is now being spread over the surface in preparation for blending
1330 stand alone camera removed from site
1333 all unwanted equipment out of structure
1340 Ken preparing to operate skid steer inside structure
1350 Operations ongoing – midrange zeolite produces much less dust
1400 New blending system is working very well.
1410 Samples from pit (2) and blended material (1) by D1
1430 Break to clear a rock from equipment
1500 Rock cleared –start operations again
1525 Operations continuing –
1530 Pile is being reduced by loading material on conveyor to processing unit
1540 Zeolite is being premixed with clay to improve handling characteristics
1545 Low dust cloud in structure
1600 Cloud obscures 2/3 of operations-only track-hoe is visible
1615 Mixing of soil proceeding nicely.
1625 Ken calls Rob to take a little breather
1625 Commisionaire has come on duty.
1630 All staff take a break
1645 Staff back to site-processing continues
1715 Processing continues –very dusty at times
1730 Processing continues
1740 D2 radio check
1745 Shutdown commences in tent and trailers
1750 Gary to do rad survey of tent area.
1800 Rad survey complete – all readings background only
1800 CAM readings taken in work area – all readings negative
1815 D2 reports structure secure
1815 Medic off site
1830 site secure team heads for home..

10 March 02
Bullet Logs

0800 team to site
0810 D!, 2 and HYTEC secure structure
0812 A violent storm that began in the early evening of the 09 March is continuing; serious collateral damage has been encountered throughout the region. In furtherance to this all telephone communication links on base are down, power supply is continuing but there are areas around the base with no power. The surges of power have knocked out two of the conveyor systems that has effectively shut down soils process operations. D7 and HYTEC staff are in Kingston attempting to find a supplier for larger capacity conveyor motors, this may prove difficult on a Sunday. The team has spent the first two hours of this morning re-establishing the soils process operation since the large amount of precipitation over the last 24 hours has severely impaired our ability to move remediated soils is becoming very difficult; the process will now be moved inside the structure with the newly powered conveyor systems.

The project to date has gone extremely well and at this time we are still projecting a completion date of 27 March 02. However meteorological issues are beyond our control.

1020 D6 moving equipment to bins
1047 D1 , D5 and D2 devise the new dig plan
1121 HYTEC and D8 return to site with new motors for the conveyors
1150 New respirators for HYTEC staff delivered to site
1210 team from site to decon
1230 team to lunch
1330 team back at site.

The conveyor systems are now up and running, soils remediation will resume this PM

1340 D2 takes digital to site for snapies
1345 site operations ramping up
1400 D7 and D10 preparing canisters for respirator change outs
1405 digital images successfully downloaded to laptop
1415 excess equipment in the trailer moved to storage
1420 the new soils moving system is working very well
1422 D2 reports that they will require more zeolite in approx 1 hour, we can't afford at this time to open the large garage doors on the structure for fear of wind damage, we will assess in 1 hour
1450 D2 conducts CAM survey, negative G and H
1500 called Chris, we will transfer vehicles at the airport with D4 and 7
1515 the blender has blown a breaker, being repaired
1517 D2 reports that the electrical supply issues are not totally resolved
1530 D2 reports that 2 bags of zeolite have been safely brought into the structure; this is a major headache since wind velocities are exceeding 60 kph
1600 D1 and D4 are attempting to lash down the front flap on the shelters so as not to have a repeat of the DREO incident.
1600 CAMs brought in for fresh batteries and new nozzle filters.

1610 Production halted temporarily to clean one of the conveyor belts.
1640 Door off trailer again. Repairs underway.
1650 Production resumes.
1700 Trailer Door repaired
1722 D2 timecheck
1730 2 fresh CAMs sent to site
1745 D2 reports 3 bags of zeolite in the structure in preparation for Monday operations
1746 close down procedures beginning
1748 D6 and partner through decon
1755 site closed all pers coming through decon
1800 equipment shut down, email being sent in shortly

11 March 02
Bullet Log

0700 team assembles
0715 team arrives at site
0718 generators up and running
0720 CADs stations being prepared
0722 site being prepared for rad survey
0723 Sheilagh Sparkes (DREO) called reference supply of CAMs for borehole work (Tuesday, 12 March 02)
0730 D5 is at the site preparing the face of the excavation for soils sample removal
0736 D6 will conduct sampling of soils from points: **A1, 2, 3, and 4**
0745 team moving to site
0750 coms checks complete
0800 Rad survey of the site is in background
0800 Paramedic on site
0815 blending ops begin
0840 D8 back to trailer
0841 D8 delivers CAM s to back door
0842 D9 to trailer for equipment repairs
0844 D2 changes video view
0848 D7 to town for supplies
0852 Drew drops off
0853 Drew called his haz-waste removal contractor
0910 Al from haz mat on site
0928 additional zeolite added to blend
0935 D4 to site for radio change out with D2; D2 has coms problem
0940 Blending ops progressing nicely
0944 D9 back to site
0950 D8 out for break
0955 D10 coms check, he is in hir trailer
0955 D4 returns digital video to trailer
1005 D2 advises that bag garbage is building in the containment structure
1007 D4 returns to site to consoldate the bag material
1010 D1 burn CD of digitals for PAFO
1015 D7 advises that more exhaust hose is required, D1 will pick up a local phone book for the trailer

1016 D2 advises he is coming up for a break and to discus progress so far
1029 D1 back at trailer
1030 hazardous waste removed from site
1045 A pocket of vials has been uncovered
1050 samples of the soil around the vial pocket have been removed for rad analysis.
1055 Vials being recovered and processed in koh\me
1055 additional koh\me being mixed
1055 CAM surveys negative H and G
1059 new exhaust hose located, drew and D4 will pick up
1105 D2 continuing to recover vials and process
1107 HYTEC at trailer taking a break while recovery continues
1108 all operations suspended till further notice; D1 and 2 conducting a risk analysis of the current vial situation
1109 Rad soil samples back at trailer, they will be analysed immediately
1114 D5 provides sit-rep; sporadic quantities of vials still being recovered, CAM surveys are negative on H and G. Continuous CAM monitoring is being done
1117 Lynne Rockwell from ADM S&T called ref the 1 day media course..I requested the 22 March if I am available. Will notify Patty Doonan soonest
1118 D2 sit rep..only a few vials in various locations of the pit being recovered
1144 D2 reports that they will end recovery of vials very soon and break for lunch
1147 1 pail of uncrushed vials recovered from pit
1148 D5 mixing more zeolite with product
1155 D2 reports site is safe last CAM survey negative H and G
1158 Team back to decon
1215 Team to lunch
1300 team back at site
1300 the cutting torch has not arrived on site as yet, the hopper must be removed before dig ops begin
1320 D4 (Gary) and D7 (Dean) have left for home, the will meets Chris Adie and Al Verpy at Ottawa airport; Chris will drive Gary and Chris to their hotel for an overnight stay prior to flying, Chris and Al will drive directly to the site
1330 spoke with Terry Medinger ref work at the site
1335 called Hertz for hydraulic fluid for the trackhoe
1340 site fully operational, soils being moved and blended at a good pace
1345 D2 CAM survey negative H and G modes
1415 Hertz on site with cutting torch
1425 the site has lost power..the main breaker panel has problems; all other breakers in the system are good.
1430 Drew notified of power situation, he will call the sparkies
1432 Hertz to site for cutting work
1445 power restored to facilities and site
1450 spoke with sparkies, no reason for main breaker to blow; hope it doesn’t happen again
1455 D2 conducts CAM survey, negative H and G
1512 equipment modifications and site reconfiguration complete, digging recommences
1518 Drew at trailer with VCR tapes

1530 in accordance with the soils sampling plan, Line B, samples 1, 2, 3, and 4 have been recovered
1544 D2 requests 2 wrenches to the site
1545 D6 requests I take a digital camera with me to Ottawa in the AM.
1551 rad samples from A1 A2 locations read back ground
1602 D6 prepares for return to site with digital camera
1605 D1 recording actions inside tent
1616 D5 request for more zolite
1617 Security arrives
1619 D6 departs for tent
1630 Power down for the second time
1645 got hold of Drew he will call out the sparkie
1655 D6 to site to spell off D9 and conduct end of day rad survey
1657 D9 out through decon
1730 process continuing, soils are blending at a steady rate
1745 Chris and Al arrive at site
1755 D2 places last soil load in blender
1755 Site closure procedures beginning
1756 The sparkie will be on site at about 1900 hrs
1800 Drew gives Al a tour of the building
1810 site closed, safe and secure
1811 rad in background
1812 chem survey negative H and G
1812 bullets closed

Project BRACER Bullets
March 12, 2002

0715 Dennis and Brian arrive on site
0720 Staff arrive
0735 Staff dressing
0740 D2 gives tour of site to Chris (D3) and Al (D4)
0750 CAM survey negative G/H
0800 Begin to process soil
0812 D9 radio check
0813 D8 radio check
0814 D5 radio check
0820 Trailer cleaning, Asked staff to remove rubber boots before entering trailer
0900 Dirty clothing placed in Paul Bunyon for shipment back to DRES
0905 D2 to trailer with EPD's
0920 Gear oil for Bobcat arrived
0930 Coffee break D8 D9
0950 CAM survey negative G/H
1020 Visit to trailer by Base Commander (20 min)
1030 D3 working in shelter, D2 to trailer
1030 Blender jammed, adding Zeolite to thin out mix
1100 Blender operating, soil processing continues
1200 Have completed all soils in North shelter
1215 Lunch

1315 On site
1320 Dumpster arrives on site
1325 Rad survey of shelter by Rob and Jay
1325 D5 moving treated soil outside shelter to make room for next dig
1335 Loading dumpster with empty Zeolite bags, pallets and plastic covers
1410 Trackhoe uncovered a small burn pit (1 meter x 1 meter) located at south end of large shelter immediately below the gravel fill layer. The pit contained 2 small empty vials, broken glass from a 2 lt jar and 2 footwear inner soles. Area and items CAM, no response on G or H. Items placed in decon solution
1425 Zeolite dumped in burn pit
1430 Digging and processing of soil continues
1455 D5 reorganizing equipment inside central shelter
1520 Taking soil samples at Position D. Soil at this position is only 1 foot deep, therefore Samples marked D1 and D2 were the only ones taken

D4 to site, D3 returns from site.

1600 Temp +4 degrees C, wind 1 km per hour from the SW, humidity 70%
1650 D9 replaced by D8 at site
1710 D6 down to site to take samples C2 and C4
1730 Al back to trailer, Pierre to tent to help close up, Rocks being picked up and put in hole
1735 Jim to trailer
1745 CAM survey- Negative readings in G and H. Rad Survey Background readings in Alpha and Beta
1748 Pierre and Red to trailer, Medic (Susan) released
1750 Rob, Brian and Dennis to trailer
1752 Jim to trailer, Shut down of site complete. Video on, Commsionaire on site for turnover

13 March 02
Bullet Log

0700 team assembles
0710 team on site
0740 coms checks complete
0745 D5, 6, 8, and 9 to site
0800 Medic on site (Karrie)
0800 soil processing begins
0850 D5 to trailer for break
0905 D5 returns to shelter
0930 Ken returns from Ottawa
0930 Andrew to trailer
0950 Chris and Rob to purchase equipment
1000 D9 to trailer for break
1010 Andrew departs trailer
1050 CAM survey, neg response on G and H
1120 Processing stops to bring Zylite into shelter
1130 Processing commences
1145 Chris and Rob return to trailer
1200 all Call Signs return to trailer for lunch break

1205 shelter secure
1210 Lunch
1300 Back from lunch
1315 On site
1320 Rad Survey Background in Alpha/Beta
1330 Processing continues and site cleanup for tent move begins
1345 Delta 5 replacing Brian
1415 Temperature 8°C Wind 290° at 6 K
1430 Delta 6 change out with Delta 2
1500 d2 and d1 complete structure move plans, D3 to purchase more hardware in the AM
1500 Drew back at trailer
1538 tape change on new video unit
1554 called Battlefield ref the skyjack rental; they will call back with availability
1600 soil sample C1 has been taken
1600 commissionaire on site
1602 conveyors running again
1610 Battlefield call back; skyjack will be delivered at 2 pm
1620 D8 and 9 preparing to return after break
1625 D6 reports more lime found on site
1625 D2 preparing to go to site
1630 D3 to site with Digital video
1645 D4 and D6 return to trailer
1645 D3 returns to trailer
1700 HYTEC move heavy equipment outside compound area; to be picked up later by contractor
1722 d2 advises site closure procedures underway
1735 Rad survey taken in Alpha/Beta Background readings. CAM readings in H and G Negative results
1738 Close out procedures complete, structure secure

14 March 02
Bullet Log

0700 team assembles
0710 team to site
0720 discuss the work plan for today
- Continue to process the remaining soil
- Purchase 6 more tension straps
- Prepare the lumber skids for structure move
- Make corner and mid-point stress relievers for structure
- Move non essential equipment out of structure

0730 team preparing for deployment to site
0732 D2 and 1 briefing team on the structure move plan; hopefully the structures
0740 D1 copies digitals from DREO to file (cd and Bracer4 folder)
0745 D6 will be off-site for approximately 1 hour
0750 D2 organizing crew
0755 video recorders started
0800 Chris setting up the new automated met station
0800 trailer needs leveling; D1, 2 and 4

0800 met station functioning; wind speed 12.2 kph, direction, 180 degrees, temp 2.8 c
0800 Paramedic on site (Percy)
0820 trailer leveled
0855 received 6 x XXL NBCW suits from Montreal
0910 D1 and 2 complete cost projections for the project
0912 called J.C Kenny at CBC radio she will conduct an interview between 11 and 12 am today
0915 water supply replenished
0925 Chris back from supply run
0935 D6 back on site
0936 D8 glove changeout
0940 more zeolite added brought into structure
0950 met update, Wind direction, 110 at 6,5 kph, temp 2.3 c.
0955 D3, 4 and 2 Preparing stress rigging for structure
1007 D6 downloading spectra data
1030 soils process continuing
1030 transmitted spectra to To vial email
1030 called Colin Overy ref MICRADS contract
1100 Lumber arrives on site D1, 3 and 4 unload
1105 D1 called amex to request an update of travel arrangements
1155 J.C arrives
1225 J.C leaves after interview
1255 D8 from site
1255 D9 from site
1255 both through decon
1305 Col Atkinson on site
1320 D2 declares that this portion of the dig is complete.
1325 structure removal operations will commence after lunch
1330 team returning from site
1331 D2 reports CAM survey of site negative H and G
1332 soils at the site have been leveled and the site is safe
1435 team back on site..all hands to structure relocate
1830 All 3 structures successfully relocated
1845 site secured for the evening

Project BRACER Bullets
March 15, 2002

0715 Arrive on site
0720 The AM goal is to finish setting up equipment inside shelter. Digging should commence after lunch
0730 Wind from SE at 9KPH - Temp 0 degrees C
0735 Rad survey conducted inside shelter, background levels
0800 Medic on site (Susan)
0805 D3, D5, Rad 2 (Jason), D8, D9 setting up equipment
0830 D4 to pick up laundry in Kingston
0845 Video feed from shelter reconnected
0900 D4 returns
0900 D5 removing gravel cover from West end of shelter using Trackhoe

0930 Medic switched out (Sean)
0945 Andrew Wollin tour of site by Jim
0955 Contacted Battlefield Rentals to info them we no longer need Skyjack
1000 Contacted Hertz Rentals to pick up second Bobcat and forks
1020 Wollin departs trailer
1050 Wind from the SE at 21KPH, Temp 3 degrees C
1130 Break for lunch
1240 Return from lunch
1250 Move zeolite into shelter D5, D8, D9.
1300 Radio check all call signs -- Soil processing starts D5 Rad2 D8 D9
1330 D3 and Rob Jr. to Kingston to pick up flex hose
1345 Wind from SE at 5 KMH Temp 7 degrees C
1420 Received shipment of additional coveralls and filter canisters from DRES
1430 D3 returns with flex hose and spade shovel
1445 D8 change out with Rad 1 (Rob)
1500 D9 change out with D6
1500 Medic change (Ian for Shawn)
1530 Wind from the S at 21KMH Temp 5 degrees C
1600 D8 in to replace Rad 1
1600 D9 in to replace Rad 2
1600 D4 returns to trailer
1615 Andrew to trailer
1620 Bringing Zeolite into structure
1645 Rain begins
1700 Due to low light conditions shutting down operation
1705 Rad survey, background levels normal, CAM survey negative in G and H
1715 Shelter secure

Project BRACER Bullets
March 16, 2002

0715 Arrive on Site
0730 Discussing today's dig plan with team members
0745 Radio checks for all Call Signs
0750 D2 D3 D5 to shelter to review digging options
0755 Wind from the E at 4 Kph Temp minus 5 Degrees C
0800 Medic arrives (Gail)
0800 CAM Survey - negative on G and H modes. D2 D3 back to trailer.
0800 Digging commences
0800 Andrew to trailer
0820 D8 D9 moving 2 x 12 lumber
0840 Soil processing commences
0845 Andrew departs trailer
1010 Break for all Call Signs
1030 D4 D5 Rad 1 Rad 2 to the shelter
1030 Wind from the SE at 11Kph Temp minus 3 degrees C
1035 Soil processing continues
1150 Break for lunch
1150 CAM Survey – negative on G and H modes

1150 Rad Survey – background only
1300 Return from lunch
1300 Wind S at 13 Kph Temp 0 degrees C
1310 Bring Zeolite into shelter
1530 Break for work crew while pit is backfilled
1540 Visit to site by Mr. Hamish St. Rose from Env Canada (Andrew escort)
1600 Visitors depart after touring shelter, PANS/EECS, TNU, and trailer
1600 D5 and Brian moving processed soil outside shelter.
1600 CC of C guard on site
1620 D8 and Rad 2 helping D5 to remove processed soil from shelter.
1625 Wind S at 4 Kph Temp 4 degrees C
1730 All soil in the central shelter have been processed. No lab waste encountered.
1745 Rad Survey – background only
1745 CAM Survey – negative G and H
1800 Shelter secured

Project BRACER Bullets
March 17, 2002

0815 Arrive on site
0815 Medic on site (Graham)
0815 Wind S at 5 Kph Temp minus 2 degrees C
0815 General discussion of today's work with team members and medic
0830 Maintenance of equipment used in shelter (clean air filters/windows/gauges, etc)
0900 Moving Zeolite into shelter
0930 Moving processed soil outside shelter
1140 Wind SE at 23 Kph Temp 2 degrees C
1145 Break for lunch
1315 Return from St Patrick's Day lunch
1315 Wind SE at 25 Kph Temp 4 degrees C
1315 Team members prepare for afternoon dig
1320 Radio Check all Call Signs
1325 D3 D5 D8 D9 to shelter
1445 Andrew to trailer
1450 Rad 2 in to replace D3
1500 Rad 1 in to replace D8
1500 D4 in to replace D9
1515 Break for all Call Signs
1535 All Call Signs back to shelter
1540 Wind SE at 18 Kph Temp 4 degrees C
1545 Andrew departs trailer
1610 CC of C guard arrives
1715 All Call Signs depart shelter
1720 Rad Survey – background only
1720 CAM Survey – negative G and H

Project BRACER Bullets
March 18, 2002

0715 Team on site
0720 Clearing snow away from trailer and shelter
0730 Team meeting to discuss day's activities. Main goal is to process all surface gravel in east shelter.
0740 Wind from SE at 7 Kph Light snow Temp 0 degrees C
0745 D5 moving Zeolite into shelter
0800 Medic on site (Graham)
0800 D5 mixing soils inside shelter
0805 Radio Check for all Call Signs
0830 D8 D9 to shelter for soil processing
0930 Visit by Capt. Doucet, discussed progress over weekend
0940 Capt. D departs trailer
1000 All Call Signs return to trailer for break
1005 Ken back on site
1015 Delta 1,2,5 to site for discussions
1035 Hytec, Delta 5,8,9 to tent
1040 Resume processing of soil
1042 coms checks complete
1045 bullets from 15, 16 and 17 March copied to master lap top
1100 Gerry Fitzgerald called to confirm he will be on site Thursday AM
1140 D8 D9 return to trailer
1140 D5 bring Zeolite into trailer
1200 Team off site for lunch
1250 team back to site
1300 paramedic change-out Susan for Graham
1305 Wind SW at 8 Kph Light Rain Temp 1 degree C
1320 D5 D8 D9 to shelter for soil processing
1330 Rad Survey conducted by Rad 1 – background only
1400 Battlefield arrives to pick up Skyjack
1410 D1 and D2 provide Progress Briefing to Base Commander
1425 D8 D9 to trailer for break
1430 D1 and D2 return to trailer
1435 D5 to trailer for break
1500 D3 D5 D8 D9 to shelter for soil processing
1500 D1 D2 producing interim Financial Report
1600 Andrew to trailer
1615 CC of C guard arrives at trailer
1620 Wind W at 0.5 Kph Light Rain Temp 2 degrees C
1635 Taking soil samples from mid and bottom levels of North East corner of shelter
1645 2 soil samples passed to Andrew
1650 Andrew departs trailer
1650 D3 returns to trailer
1700 Rad and CAM survey. Rad at background. CAM negative in G and H
1720 Site secure

19 March 02
Bullet Logs

0700 team assembles
0715 team arrive on site
0730 D1 and D2 review the latest dig plan
0740 D1 provides the team with information reference site visits (Eco-Logic, Marathon Engineering and DRES environmental officer, 20 March 2002)
0750 D1 briefs team reference the need to ramp up protective ensemble levels; (top)

NOTE 1: D2 and D1 have informed the team that the dig is entering a phase where the likelihood of uncovering hazardous product is increasing, therefore the protective ensemble levels will be re-established to top-high. The remaining portion of the dig is an area where soil depth is approximately 6 feet. Both D1 and 2 believe if a second pit exists it will be in this region.

NOTE 2. D1, 2 and 6 will prepare (1630 hrs 19 March) for the intrusive investigation of B-55 basement; the work will begin at 1700 hrs and will include CAM, Paper, AP2C and radiological sweeps.

0755 Paramedic (Geoff) arrives on site
0800 Drew on site
0800 Both VCRs loaded and running
0805 D1 provides Drew with a rough cost estimate for the project
0815 team begins dress procedures
0815 HI-6 issued (2 per man
0820 Paramedic briefed on the days operations
0825 CADS station up and running (test good)
0830 weather station up and running, Wind speed, 1.4 kph, Dir, 160 degrees, Temp –2c
0835 EPDs and rad survey complete
0840 CAM survey complete, negative H and G
0840 bobcats refueled
0845 all site equipment up and running
0847 coms check complete
0900 operations commence
0910 D4 to Kingston
0930 Digital cameras to site (video and still)
0930 D1 and 4 prepare presentation
0940 D2 sends cameras back to decon
0941 D1 secures compound
0945 D2 reports CAM survey negative on both H and G modes
0950 D1 change digital video tape, mark tape as end 19 March 02; re-load new tape mark as start 19 March 02
1000 D2 takes digital to site
1020 D2 brings digital back
1025 D4 preparing to go to site
1045 D4 using power wash to clean equipment
1045 D2 reports 15 bags zeolite moved into shelter

1045 D2 reports 50% of the soil removed from the north side of the excavation; the excavation is down at bedrock (depth of 8 feet)
1048 D3 and 4 replenish water supplies
1055 all zeolite now inside structure
1105 D2 recovers 3 samples for rad analysis
1107 D1 and 3 complete collation of presentation jpegs and burn to CD
1115 D5 to move more zeolite inside structure
1117 D2 sends 4 field operators back for decon
1118 D2 requests rad survey of site
1125 D2 reports CAM survey negative H and G modes
1135 D6 to site for rad survey
1145 D6 reports rad survey is in background
1150 the site is secure and in a safe condition
1255 Team back on site
1305 team to site
1320 D1 and Col Atkinson to H-55 to check out the location of the basement trap door
1330 Delta 8 radio check
1331 Delta 9 Radio check
1331 Delta 5 Radio Check
1335 Delta 2 and 9 change out of radios
1340 Delta Dawn Radio check
1342 Delta Dawn to run outside bobcat
1345 D1 back at trailer, trap located
1600 Delta 2 out for crawl space work
1630 Delta 1,2,6 dressed for crawl space work
1640 CAM survey negative in G and H . RAD survey background
1650 enter of crawlspace. No returns on all samplers. Rad to follow.
1710 Site secure

20 March 02
Bullet Log

0700 Team assembles
0713 team on site
0715 Team planning meeting ref the days objectives
0730 test and process equipment up and running
0740 the plan will see continuing efforts in soils processing, the work is going well and the projection of soils being completed by COP Friday is realistic..baring any unforeseen events or discoveries
0750 zeolite being moved into structure
0755 Paramedic (Percy) on site, D1 briefed percy as to the plans for the day and past events
0800 coms checks good
0815 rad survey complete..all in background
0825 CAM survey negative in both H and G modes
0840 Met station takes another tumble
0840 Wind dir, 168 degrees, speed, 3.4 kph, Temp, 1.5 c
0850 D1 and D3 complete the briefing package, it was worked on last evening
0855 D3 to Kingston to pick up a quantity of CD-Rs in order we make copies of the digitals and presentations for all team and project members

0900 D4 continuing clean up work in trailer, the weather is causing a logistical nighmare with the traking of mud into the decon facility

20 March 02
Bullet Log

0700 Team assembles
0713 team on site
0715 Team planning meeting ref the days objectives
0730 test and process equipment up and running
0740 the plan will see continuing efforts in soils processing, the work is going well and the projection of soils being completed by COP Friday is realistic..baring any unforeseen events or discoveries
0750 zeolite being moved into structure
0755 Paramedic (Percy) on site, D1 briefed Percy as to the plans for the day and past events
0800 coms checks good
0815 rad survey complete. all in background
0825 CAM survey negative in both H and G modes
0840 Met station takes another tumble
0840 Wind dir, 168 degrees, speed, 3.4 kph, Temp, 1.5 c
0850 D1 and D3 complete the briefing package; it was worked on last evening
0855 D3 to Kingston to pick up a quantity of CD-Rs in order we make copies of the digitals and presentations for all team and project members
0900 D4 continuing clean up work in trailer, the weather is causing a logistical nightmare with the tracking of mud into the decon facility
0905 picked up Colin Overy at main gate, discussions ref AECL projects
0930 soils being processed
1025 Colin Leaves for Brockville
1027 D2 requests time check
1030 D3 returns from Kingston
1030 site process going well
1045 wind dir 150 degrees, speed 0 kph, temp 0.9 c
1130 D2 conducts CAM survey negative H and G modes
1133 D2 sending 2 up for decon
1136 D3 and 4 prepare decon line
1140 D6 ready to depart for site to conduct rad survey
1142 D6 to site
1142 Drew to trailer
1144 2 through decon
1145 CADS station malfunctioning therefore 1 tech has been assigned to monitor CAM responses full time
1148 Rad survey changing out equipment since the met conditions are affecting the ADM 300.
1205 team to lunch
1300 team back from lunch
1340 Team back in tent processing
1400 Rad check indicates Radium which is normal for the area
1435 Eco Logic on site
1555 Tour of site

1600 Temp .7°C wind 267 at 0
1610 Delta 1,2 and Ecologic off site
1625 Digging of the rest of the hole begins
1630 Delta 8 received new gloves to take samples
1640 Delta 8 and 9 to trailer for Decon with samples from the south east corner mid and bottom
1815 Dennis to trailer for decon
1825 CAM survey negative on G and H. Rad Survey Background in Alpha and Beta
1830 Delta 5 and Brian to trailer for Decon
1835 Site Secure

21 March 02
Bullet Log

0700 Team assembles
0700 DRES EO on site
0720 all site staff ready and deploying to site

NOTE: all hazardous recovery operations are complete as of this time, no additional product was recovered during the soils dig yesterday. The major portion of work left is the processing of this large quantity of recovered soil; Projections have us finishing this portion of the job by Friday AM.

0745 D2 takes liquid sample from koh\me for rad survey
0750 The TNU is being prepared for final burn. There is approximately 3 X 5 gallon pails of recovered product and past samples which will be processed.
0800 Paramedic (Percy) on site
0810 D4 preparing the TNU
0813 D6 preparing the samples for TNU
0815 DRES EO to site.
0815 Met Conditions: wind dir, 290 degrees, wind speed, 0.0 kph, Temp +1.5 c
0817 D4 and D6 draw off methanol for TNU
0825 called Battlefield rentals to have Skyjack delliverd to the site at 0900, 22 March 02
0830 Zeolite being moved into facility
0910 TNU loaded and lit
0920 TNU temps are 800 c internal and 720 at the stack
0925 D4 taking additional laundry to Kingston
0945 D1 and 6 consolidating containers and waste for off site disposal
0950 TNU burn complete
1000 Drew on site
1030 D1, 4 and 6 continue tear down and re-pack work
1045 Drew leaves
1050 arrangements are being made to pick up empty methanol barrels and haz waste, also pressurized gas cylinders will be picked up tomorrow
1124 D2 requests time check
1135 D3 and DRES EO through decon
1140 D5 and 2 secure site
1155 teams leaves for lunch.

NOTE: rad surveys of the site have been terminated, the final survey of sopil was in background

1300 team back on site
1315 D1 to Hotel to start report
1335 soils ops ongoing
1400 D3 back on site
1500 Waste container emptied and returned to site
1515 Pressure washer arrives on site
1650 sit-rep reports approx 30 minutes of processing remaining
1730 Processing complete
1735 D6 returns rad survey equipment to base
1740 generator removed from process facility and placed in parking lot
1748 D2 returns to trailer to brief D1
1752 Second conveyor system removed from facility
1800 site secured, project processing phase completed safely….

NOTE: operational bullets are now complete, notes will be forwarded to addressees as per bullets…

ANNEX F – RADIATION SAFETY PROTOCOL

RADIATION SAFETY PROTOCOLS

Introduction

1. The CFB Kingston project involves the recovery and disposal of waste generated by the Department of National Defence, Research and Development program-related waste being deposited in a large trench. The trench is located on the property of CFB Kingston, on lands currently administered by the Department of National Defence (DND).

2. The CBR Demilitarization Project Team from DRDC is responsible for excavation recovery and segregation of any potential CBR products and related materials from the trench, and disposing of this waste on-site using chemical neutralization, bio-detoxification and in emergency situations thermal treatment methods. Conventional waste will be segregated and transferred to a contractor (yet to be named) for disposal at commercial facilities.

3. The CBR project team may transfer any radiological waste recovered from the remediation to Defence R&D Canada - Ottawa (DRDC Ottawa) for disposal in accordance with DRDC Ottawa protocol and appropriate regulations that govern these materials.

Personnel Safety

4. Documentation associated with the use of the disposal trench suggests that the likelihood of encountering radiological waste is small. Nonetheless, the DRES Team will take the following safety precautions with respect to radiological materials:

a. one of the five-member DRDC Suffield Team is the radiation safety officer for DRDC Suffield and is trained in surveying, handling and storage of radiological materials;

b. all personnel working on waste recovery operations wear direct read-out radiation safety badges which are checked daily and the read-outs recorded in the Project daily logs;

c. the Canadian Forces Nuclear Biological Chemical (NBC) Individual Protective Ensemble, including C4 respirator, NBC over-boots and gloves are worn by all personnel working on waste recovery operations. This ensemble is augmented with Atomic Radiation Worker over-boots and heavy work gloves;

d. all personnel working on site undergo personnel decontamination at the end of each work shift, including doffing of protective clothing and showering as a final activity before doffing personal clothing and leaving the Project command centre; and

e. all workers carry portable radio sets operating on the DRDC Suffield communications net and command centre base radio for instant communication.

Waste Recovery Protocol - Radiological Materials

5. A 25 m safety template is established around the work site with entry/egress to the site controlled through the project Command Centre/Decontamination Trailer facility. Only project personnel or other designated personnel may enter the site and must wear the protective ensemble described in para 4 c, above.

6. All items recovered during excavation and recovery operations are first surveyed with radiation survey meters for Alpha +Beta and Gamma emissions. The soil in the vicinity of recovered items is also subjected to a radiation survey. Results of the survey are communicated to the Command Centre for entry into the daily logs.

7. The radiation surveys are immediately followed by CAM (Chemical Agent Monitor) survey using instruments operating in the H-, G- and VOCs-mode to determine the presence of any chemical warfare agent hazard.

8. Items which show significant increase in radiation emissions above background levels are immediately segregated into separate containers for further processing;

a. items with no evidence of contents other than radiological material are further segregated and placed in a container of 5% bleach solution to decontaminate the outer surfaces of the item container and remove any CB hazard. Radiation specialists are immediately transfer the materiels to a safe location to await transport to DREO where they will be stored and disposed of in accordance with DREO protocol. The bleach solution is subjected to a radiation survey to determine if the solution also represents a radiation hazard;

b. items suspected of having a combined CBR hazard are immersed in a KOH/methanol (min 20 litres) in a plastic pail and opened while submerged thus allowing the neutralization solution to destroy the CB hazard. Opening can consist of removing closures (e.g., screw caps on vials) or drilling open using a pneumatic drill. In some cases, glass items can be crushed using a hammer or pliers. The methanol solution now containing the neutralized/detoxified CB material as well as the

radiological hazard is transferred to DREO for processing as per para 8a; and

c. soil found with radiological contamination would be packaged in over packed drums for transfer to DRDC Ottawa.

Waste Processing - Other Materials

9. All materials recovered from the site, including the excavated soil or soil in the vicinity of recovered items is subjected to a radiation survey before further processing is undertaken.

10. All solutions used to neutralize CB materiels are subjected to a radiation survey before and after the neutralization process;

11. All items placed in the TNU apparatus are subjected to radiation survey before and after the treatment process. Generally, any item that have detectable radiation levels would NOT be processed in the TNU but would be segregated for transfer to DRDC Ottawa.

ANNEX G – PROJECT BRACER INTEGRATED RADIOLOGICAL PROTOCOL, SAMPLING

PROJECT ORACLE

Integrated Radiation Safety Protocol

Introduction

1. Project BRACER (Biological, Radiological and Chemical E Remediation) involves the recovery and disposal of waste generated by the Defence Research Board, Kingston Labs program. Program-related waste was deposited in pits during the period –of 1940s to 1960s.These pits are located at CFB Kingston.

2. The CB Demilitarization Project Team from DRDC Suffield is responsible for excavation, recovery and segregation of any potential chemical-biological warfare and related materials from these pits, and disposing of this waste on-site using chemical neutralization, bio-detoxification and thermal treatment methods. Conventional waste will be segregated by DRES and transferred to the CFB Kingston contractor (TBD) for disposal at commercial facilities. Any radiological waste recovered will be transferred to DRDC Ottawa personnel for analysis and disposal in accordance with DRDC Ottawa protocol and appropriate regulations that govern these materials. It will be necessary during the conduct of the project to address and protect individuals from the potential of mixed nuclear, biological and chemical hazards. This is the goal of the bulk of the document.

3. Col R. Atkinson, Base C.O. is the overall authority for Project BRACER and represents the single point of accountability.

4. There will be no excavation, waste treatment or disposal of any kind, without Dr. Tom Cousins and/or Mr. Diego Estan (DRDC Ottawa) and Mr. Ken Pirie's (DRDC Suffield) presence on the CFB Kingston site. In the event of the absence of either Dr. Cousins/Mr. Estan or Mr. Pirie, a qualified person(s) may be appointed to act as radiological, biological or chemical authority(ies) on their behalf. DGNS will be immediately informed of the person(s) assuming the radiological responsibility.

Personnel Safety

5. Documentation associated with the use of the disposal pits suggests that the likelihood of encountering radiological waste is small. Nonetheless, the DRDC Team will take the following safety precautions with respect to radiological materials:

a. One of the seven-member DRDC Suffield sub-Team is the radiation safety officer for DRDC Suffield and is trained in surveying, handling and storage of radiological materials;

b. All personnel working on waste recovery operations will wear both direct read-out radiation safety badges (EPDs) and DRDC Ottawa's hypersensitive Al_2O_3 TLDs, which are checked daily and the read-outs recorded in the Project daily logs. Should the dose reading on **any** dosimeter exceed 1 microSv (0.1 mRem) in excess of natural background (which is around 0.1 mRem per day and will also to be recorded daily by dosimeters in the on-site Mobile Nuclear Lab)- the DRDC Ottawa RadSo (or deputy) and DGNS will be advised and an investigation started. The project shall be suspended immediately should any dose exceed 5 mRem in any day until the cause is determined. (Note that EPD alarm levels will be set to match this condition as well as possible);

c. The Canadian Forces NBC (Nuclear Biological Chemical) Individual Protective Ensemble, including C4 respirator, NBC overboots and all personnel working on waste recovery operations shall wear gloves. This ensemble is augmented with Atomic Radiation Worker over-boots and heavy work gloves;

d. All personnel working on site undergo personnel decontamination at the end of each work shift, including doffing of protective clothing and showering as a final activity before doffing personal clothing and leaving the Project command centre;

e. All workers carry portable radio sets operating on the DRDC Suffield communications net and command centre base radio for instant communication;

f. Prior to commencement of the project, all personnel involved shall be provided with awareness briefings, provided by DRDC Suffield and DRDC Ottawa personnel on the nuclear, biological and chemical hazards that may be present and how the integrated process adequately addresses each of these;

g. All personnel will be briefed on the “General Instructions for Initialization of Emergency Response Actions Specific to Project Bracer, CFB Kingston, Ontario”, Jan 2001;

h. Similarly, DRDC Ottawa sub-team personnel will take the following safety precautions in handling bio-chem neutralized waste:

   (1) Any opening of chemical vials or containers suspected of having radiological material fills or contamination shall be conducted inside the confines of the DRDC Suffield Portable

Assessment and Neutralization System (PANS); the PANS will be located inside the on-site environmental structure. Training specific to the use and operation of the PANS will be provided by DRDC Suffield; and

(2) DRDC Suffield field technical staff in support of the DRDC Ottawa team members will use two handheld Chemical Agent Monitors (CAM) operating in G and H modes when it is suspected that Chemical agents may be present. DRES staff will also provide training to the DREO team members in the operation of CAM.

Waste Recovery Protocol - Radiological Materials

6. A 25m-safety template shall be established – for chemical hazards - and where possible the template will be clearly marked with survey tape. This template will be vigorously enforced if and when radiological contamination is confirmed, by further initially limiting access to DRDC Ottawa personnel only. This safety template can and should be extended if DRDC Ottawa staff assess that the radiological risk warrants it. Entry/egress to the site shall be controlled through the DRDC Suffield Command Centre/Decontamination Trailer facility. Only DRDC personnel or other designated personnel may enter the site and must wear the protective ensemble described in para 4 c, above.

7. All items recovered during excavation and recovery operations are first surveyed with an ADM-300 gamma survey meter as well as an ADM-300 alpha-beta probe to ensure the personal safety of all those involved in the excavation. Soils in the immediate vicinity of recovered items shall also be subjected to a rad survey.. Results of the survey are communicated to the DRDC Suffield Command Centre for entry into the daily logs. Soil samples shall also be removed for more detailed radiological and chemical analysis as described in para 10c below.

8. The radiation surveys are immediately followed by CAM (Chemical Agent Monitor) survey using instruments operating in the H, G and VOCs-mode to determine the presence of any chemical warfare (CW) agent hazard.

9. Items (materiels) which show statistically-significant radiation emission levels for gamma-ray detection, or above the detection thresholds as defined for alpha/beta in DGNS Guide to Survey and Decontamination Activities, are immediately segregated and placed in separate containers for further processing;

10. Items, (or materiels) which contain no evidence of any contents other than radiological material are further segregated and placed in a container of 5%, bleach solution to decontaminate the outer or exposed surfaces of the item to remove any CW hazard. DRDC Ottawa radiation specialists are contacted and items immediately transferred to DRDC Ottawa personnel for handling, storage and disposal in accordance with DRDC Ottawa protocol (see para 11). DRDC Ottawa will also receive two 3 to 5 ml samples of the bleach solution and analyze these on the LSC (and possibly HPGe) systems. Should any samples yield an activity

greater than 3.7Bq/g (activity is background subtracted from blank scintillation fluid filled vial and estimated as worst case if isotope and quenching factor are unknown), further sampling shall ensue. Furthermore, isotopic analysis shall also follow with immediate contact of DGNS.

11. Items suspected of containing a combined radiological/ CB hazard are immersed in a minimum amount of KOH/methanol in a 20 L plastic pail and opened while submerged to allow the decontaminant to destroy the Chemical or Biological hazard. Opening a can consists of removing closures (e.g., screw caps on vials) or drilling open using a pneumatic drill. In some cases, glass items can be crushed under decontamination solutions using a hammer. The KOH\ methanol solution now containing the neutralized/detoxified CB material and the radiological hazard is then transferred to DRDC Ottawa personnel for further processing as per para 10a, above.

12. Soil found with radiological contamination would be packaged in standard over packed drums for transfer to on-site DRDC Ottawa personnel. In addition, soil samples from the excavation shall be collected for DRDC Ottawa radiological analysis. Mr. Soucey (DRDC Suffield) or his designated replacement is responsible for collecting the samples and placing them in the appropriate vials for LSC analysis. Mr. Soucey will deliver the samples to Mr. Estan (DRDC Ottawa) who will conduct the analysis. The frequency of samples collected shall be 4 per cubic meter. If a given soil sample should exceed an activity of 3.7 Bq/g, the sampling frequency shall increase to 50 sample per cubic metre for the given area of excavation where the suspect sample was taken. These rules will also apply should there be physical evidence of radiological contamination (trefoils, etc). Furthermore, isotopic analysis of the samples shall ensue followed by contact of DGNS.

Waste Processing - Other Materials

13. All materials recovered from the pits, including the excavated soil or soil in the vicinity of recovered items is subjected to a radiation survey before further processing is undertaken. Soil samples from the excavation site shall also be collected for radiological analysis as described in para 10c.

14. All solutions used to neutralize potential CB items or related materiels are subjected to a radiation survey before and after the neutralization process. The solution used to neutralise CB contaminants are solutions of KOH/methanol. Mr. Soucey (or his designate) is responsible for providing KOH/methanol samples to Mr. Estan (or his designate) for LSC analysis. The frequency of sampling shall be two 3 to 5 ml samples per container. There will be no incineration of KOH solution prior to review of LSC analysis by DREO. Should any samples yield an activity greater than 3.7 Bq/gr, further sampling shall ensue in conjunction with the halting of incineration for the suspect container. Furthermore, isotopic analysis shall also follow with immediate contact of DGNS.

15. All items placed in the Thermal Neutralization Unit (TNU) are subjected to a radiation survey before and after the treatment process. In addition to surveying for gross radiological contaminants, the DRDC Ottawa sub-team is responsible for evaluating all debris prior to incineration. On completion of the TNU process, Mr. Soucey (or his designate) shall place all recovered tray material in an appropriate sized bag and deliver the bag to the Mobile

Nuclear Lab where the material will undergo a Microspec evaluation. Three Microspec detectors (3”x3” NaI, Low energy photon, Beta) shall be placed within immediate proximity of the bag to ascertain the presence of a radiological threat. In addition, five random samples shall be taken from the bag for LSC analysis. Materials from the bag shall be considered a radiological threat if the Microspec evaluation yields dose rates of twice background or more and/or if the LSC analysis yields activity levels of 3.7 Bq/g or more. In the event that a radiological threat is found, isotope identification (using the germanium system) and activity calculations shall ensue, followed by immediate contact of DGNS.

16. No items exhibiting radiation emissions would be processed in the TNU apparatus. The DREO sub-team is also responsible for the last precautionary measure with regards to the TNU process, that being a high volume particulate air sampler (PAM 100c) strategically placed downwind of the TNU; this sytem will be co-located with the CADs II chemical agent monitoring station. The PAM 100C will have an audible alarm set at the target limit; in addition, an air-sampler with filter shall be side-by-side with the PAM. Should any filter paper analysis (LSC) yield activity results greater than twice background; isotopic analysis and further study of TNU contents shall ensue. Background, in this case, is defined as a mean average of several runs in counts/min/litre of air sampled in the field adjacent to the excavation site.

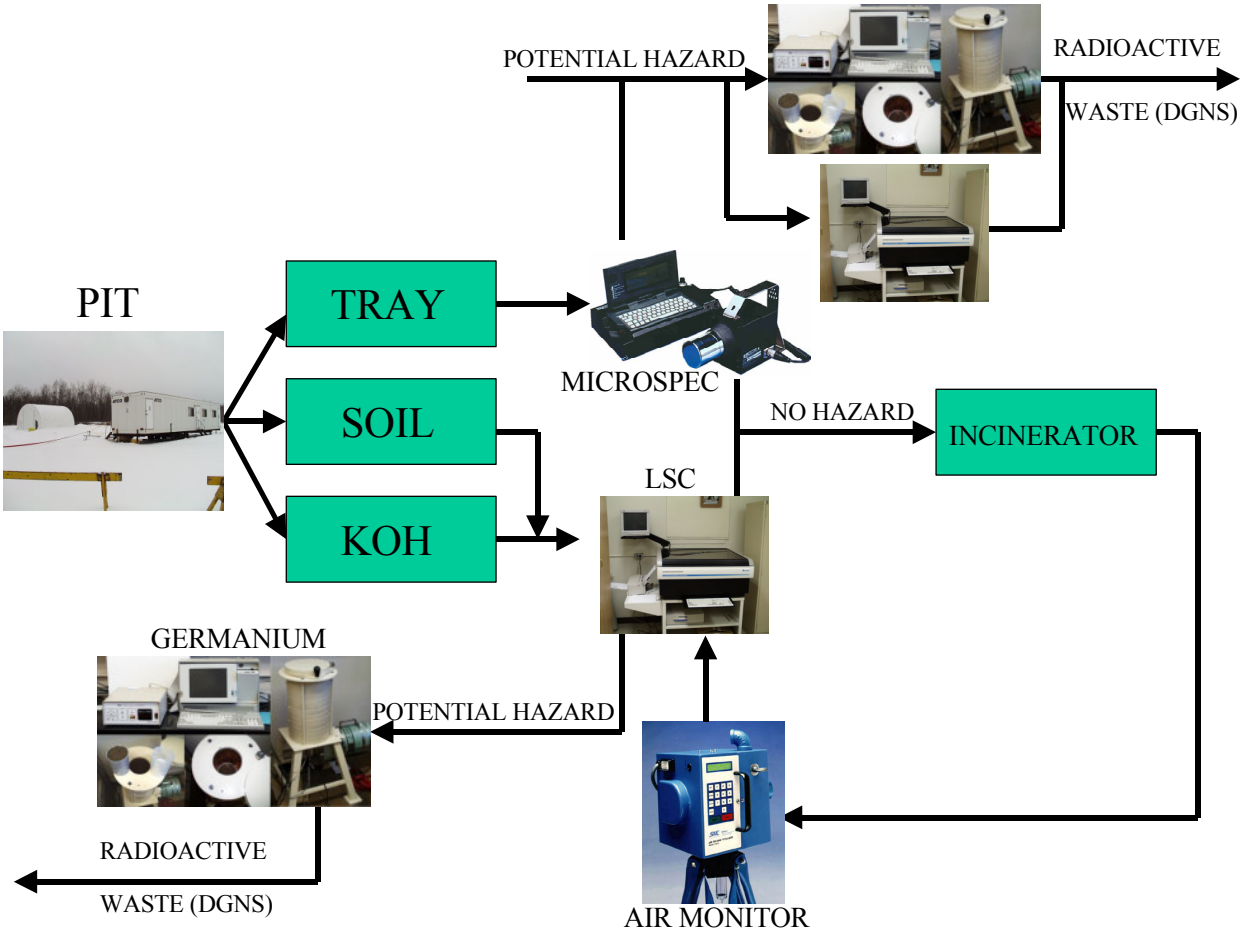
17. The samples are taken while no work is being performed at the excavation site. In addition to monitoring the air escaping the TNU during incineration, flue swipes and residual ash samples following incineration will be transferred to the DRDC Ottawa sub-team for analysis. Mr. Soucey (or designate) is responsible for delivering such samples in the appropriate vials to Mr. Estan (or designate) for LSC analysis. Initial sample frequency will be five samples and/or swipes from the TNU. However, should any sample and/or swipe yield an activity greater than 3.7 Bq/g, further ash and flue sampling will be conducted and isotope identification shall ensue.

18. Swipe pads (i.e., square grids traced out on the ground or Al plates laid out on the ground) shall be set up at various distances from the TNU in the downwind direction to allow for surface swiping at the completion of burns.

Reporting – Radiological

19. Mr. Estan is responsible for providing weekly reports of radiological findings to DGNS. The spreadsheet is broken down into four sections: Microspec data, LSC data (activity levels), Germanium data (isotopic identification and activity levels) and Air monitor data. Potentially hazardous materials found (from a radiological standpoint) shall be highlighted in the spreadsheet accordingly. Mr. Estan and/or Dr. Cousins shall be available to discuss said findings with DGNS if and when concerns arise.

Figure A1


POTENTIAL HAZARD
RADIOACTIVE
WASTE (DGNS)
PIT
TRAY
SOIL
KOH
MICROSPEC
NO HAZARD
INCINERATOR
LSC
GERMANIUM
POTENTIAL HAZARD
RADIOACTIVE
WASTE (DGNS)
AIR MONITOR

ANNEX H – PRODUCT REPORT

TOTALS
RECOVERED PRODUCT REPORT
AS OF
1730 HRS, 06 MARCH 2002

1. 4250 25 ml vials, partially filled with decontaminated swabs and liquids.

2. 3 X 5 gallon plastic pails filled with animal bedding product (wood chips and paper). This recovered waste has been autoclaved.

3. 12 jars (250 ml – 500 ml) containing dye.

4. 20 (5 ml) septum jars partially filled (injectable medical supplies)

Material on Site

1. 1 X 45 gallon hazardous waste barrell of soil contaminated with mercury and 1 X 250 ml plastic container contaminated with mercury.

2. 1 X 45 gallon hazardous waste barrel containing 5 x 5 gallon plastic pails, leather work gloves, black rubber gloves, 1 x 3 foot length of lumber, 1 steel mesh basket, 10 pounds of soil, 3 gallons of water, glass shards. All material in this container is free from biological and radiological hazards.

3. 1 X 500 ml heavy polyethylene container of hydrofluoric acid (HF) and water.

Ken Pirie
Project Manager (DRDC Suffield)

ANNEX I – POST OP ANALYSIS

Memorandum

1262-1(B Env O)

26 August 2003

Distribution List

POST-OP ANALYSIS RESULTS - PROJECT BRACER

Refs: A. Residential Water Well Quality - Aquafor Beech Ltd. 30 Apr 2002
B. Anaylsis of Residential Water Wells for Chemical Warfare Agents – Aquafor Beech Ltd. – Project BRACER 6 Jun 02
C. Analysis of Soil Samples - B Env O/Aquafor Beech Ltd. 5 Jun 02
D. Public Consultation - Project BRACER 23 Jan 02

1. Refs A, B and C are the results from samples taken IAW commitments made at Ref D. Samples for Ref A were taken at 6 private residences to the east and southeast of the Project Bracer site. Samples for Ref C were taken at two residences immediately east of the Project BRACER site. Samples for Ref C were taken during and after excavation at the project site.

2. Ref A drinking water results show no contamination by laboratory, industrial or commercial sources. All results have been hand delivered to the residents.

3. All ref A samples had elevated sodium and hardness. One sample showed evidence of septic influence, which has been communicated to that resident per MOE and MOH instruction. Samples will be taken annually for the next two years per ref D.

4. Ref B drinking water results show no contamination by chemical warfare agents of their degradation products. Samples will be taken annually for the next two years per ref D.

5. Ref C soil showed no contamination by laboratory, industrial or commercial sources. Four analyses showed traces of POL (gasoline) which is believed to have been spilled on site during the project. One sample showed an exceedance of federal criteria for Chromium. This trend was

not continued throughout the area, leading the consultant to conclude that this was an anomalous reading. There was evidence of lye in the soil which is believed to be from the original burial of the waste. Lye was used to neutralize biological waste during that era.

6. Results show no impact previously or currently to soil or groundwater from any activities at Defence Research Laboratory Kingston or the subsequent remediation.

7. As indicated at ref D, draft press release is attached for review.

8. Questions/comments to the undersigned.

Original signed by:

A. Wollin, P. Eng.
B Env O
271-4373

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LFCA Env O
K. Pirie, DRDC Suffield

Annex A to 1262-1
21 Jun 02

MEDIA ADVISORY – PROJECT BRACER FOLLOW-UP

In January 2002, CFB Kingston and Defence Research and Development Canada (Suffield) held a public consultation for the excavation and remediation of a laboratory waste site to the north of Base Headquarters.

During that consultation Colonel Atkinson, Base Commander CFB Kingston, committed to sampling the wells of any nearby resident who wished it. Four residents asked for their drinking water wells to be sampled. Two residents agreed to have their wells sampled upon a request from CFB Kingston.

During the course of the excavation and remediation samples of soil and water were taken for analysis for conventional contaminants as well as chemical agent residues.

The results have been recently received. We are pleased to announce that the analysis confirms the announcement made at the end of the project. The former Defence Research Laboratory Kingston Site contains no residues from the laboratory activities. Four laboratories analyzed soil and groundwater for more than 100 organic and inorganic contaminants. The results confirm that there has been no impact to CFB Kingston property or to neighbouring private properties.

Well water results showed elevated sodium, which is common to the area, and one resident has been informed that their well may be receiving influence from nearby septic systems. Residents were given copies of laboratory results for their wells alone, with specific advice for the sodium and suspected septic contamination as the case may be.

Water samples will be repeated annually for two years as committed to by CFB Kingston.

The former laboratory waste site is currently being turned into a park. No further restoration is expected.

- 30 –

SECURITY CLASSIFICATION OF FORM
(highest classification of Title, Abstract, Keywords)

DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (the name and address of the organization preparing the document. Organizations for who the document was prepared, e.g. Establishment sponsoring a contractor's report, or tasking agency, are entered in Section 8.)

   DRDC Suffield

2. SECURITY CLASSIFICATION (overall security classification of the document, including special warning terms if applicable)

   Unclassified

3. TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title).

   Project BRACER
   Technical Report of the Remediation of the Biological Waste Pits Located Behind Building H-55, CFB Kingston, Ontario (U)

4. AUTHORS (Last name, first name, middle initial. If military, show rank, e.g. Doe, Maj. John E.)

   Pirie, Ken

5. DATE OF PUBLICATION (month and year of publication of document)

   April 2003

6a. NO. OF PAGES (total containing information, include Annexes, Appendices, etc) 97

6b. NO. OF REFS (total cited in document) 7

7. DESCRIPTIVE NOTES (the category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

   Technical Report

8. SPONSORING ACTIVITY (the name of the department project office or laboratory sponsoring the research and development. Include the address.)

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)

9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)

10a. ORIGINATOR'S DOCUMENT NUMBER (the official document number by which the document is identified by the originating activity. This number must be unique to this document.)

   DRDC Suffield TR 2003-034

10b. OTHER DOCUMENT NOs. (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11. DOCUMENT AVAILABILITY (any limitations on further dissemination of the document, other than those imposed by security classification)

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   ( ) Distribution limited to defence departments and Canadian defence contractors; further distribution only as approved
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   Defence R&D Canada

13. ABSTRACT (a brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C) or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual).

This Technical Report details the successful remediation of the biological waste pits located at CFB Kingston, Ontario. The report offers historical account of the type and nature of work that took place at the facility as well as operational planning information, team and equipment deployment and a detailed account of the remediation work.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifies, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus-identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

Biological Waste
Site Remediation
CFB Kingston
Building H-55